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# THE THIRD REPORT

of the

# RESIDENTIAL PLANNING PROJECT

of the

DEPARTMENT OF ARCHITECTURE, UNIVERSITY OF ILLINOIS

in cooperation with

BITUMINOUS COAL RESEARCH, INC.
AMERICAN COKE AND COAL CHEMICALS INSTITUTE
ANTHRACITE INSTITUTE

prepared by

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of Architecture

CONFIDENTIAL - NOT FOR PUBLICATION

April 1, 1947 - June 30, 1947

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## I. ADDED SCOPE OF PROJECT

On June 23, 1947, a copy of the new contract between the University of Illinois and the sponsors was received in the office of this project. This contract is the result of the reorganization of the project to include as sponsors the Anthracite Institute and the American Coke and Coal Chemicals Institute, as well as Bituminous Coal Research, Inc. The essence of the new agreement is to expand the scope of the project to include consideration of all solid fuels rather than bituminous coal only. According to the contract, the term "solid fuels" refers to Pennsylvania anthracite, bituminous coal (including sub-bituminous coal and lignite), and coke. Inclusion of all the major solid fuels in the sponsorship of this project gives the opportunity for increasing the value of the study by making it more comprehensive and more complete. It also provides a splendid opportunity for the unification of the architectural knowledge and experience that these various organizations have accumulated over a considerable period of time. As stated in the Second Report, the complete coverage of the solid fuel field is most desirable for this project, and it is therefore especially pleasing to have the cooperation of all three organizations representing this field.

## II. STUDY: THE INDUSTRY ENGINEERED HOUSE

Considerable work has been done during this and the preceding quarter on studies for the Industry Engineered House.

The "Industry Engineered House" is the name given to a program of house construction study sponsored by the Producers' Council (an organization of the manufacturers of building materials and equipment) and by the National Retail Lumber Dealers Association. The purpose of this program is to develop and promote a more standardized method of residential construction which can be used by the average small home builder and which will eventually result in the reduction of building costs for residential construction.

The underlying principle of the Industry Engineered House Program is to reduce cost by more efficient use of standard size building material and products. In this regard, it is expected that the coordinated use of standard parts will result in savings both by the elimination of waste and by the reduction of labor costs. It is also hoped that the number of standard parts required will be reduced to such an extent that it will not be necessary for building material suppliers to carry as varied a stock as they do today.

In the process of development and study, the Producers' Council employed Chapman and Evans, Architects, of New York City, to make preliminary studies of several homes illustrating the principle. In their plans they made use of various combinations and arrangements of a basic plan unit 16'-0" x 24'-0" in size. The 16-foot width is convenient, as 16'-0" is the maximum unsupported distance which is acceptable for 2" x 10" floor joists placed 16" on center. It should be noticed that the dimensions of the basic unit are coordinated with the most common standard size of sheet building materials, that is, 4'-0" x 8'-0".

After the original schematics of the house had been determined, A. Gordon Lorimer, A.I.A., Technical Advisor to the Producers' Council, gave further study to the detailing of the house. One refinement in the detailing is in his application of the modular coordination principle developed by Committee A62 of the American Standards Association. For some time this committee has been working toward the eventual coordination of all building materials and products on the basis of a 4-inch module. Standard details for windows, window frames, doors, door frames, masonry, etc. have been developed and published in the A62 Guide. The manufacturers of many building materials are now making their products in accordance with the recommendation of the Guide. The Industry Engineered House has been carefully planned with the 4-inch module in mind.

In the early part of 1947, Mr. Lorimer prepared half-inch scale detail plans and sections of one of the houses originally planned by Chapman and Evans. This particular house is a single-story, L-shaped house which will be described in more detail later.

As a further study of the technique of building, the Producers' Council proposed to build several of these houses and conduct a careful time and motion study during the process of construction in order to determine where labor costs might be saved. Part of this study involved the use of normal building procedure on one house, while later houses were to be built using pre-cut materials, in an effort to save cost. It was proposed that this time and motion study be conducted at Urbana, Illinois, by the Small Homes Council of the University of Illinois, Professor W. H. Scheick, Coordinator.

## FIRST CONTACT

The plans of the L-shaped Industry Engineered House first came to the attention of this project in the week preceding February 28, 1947. The plans had been sent to the Small Homes Council for study.

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## First Plans of the Industry Engineered House

On February 28, 1947, the plans for the house were as shown below:

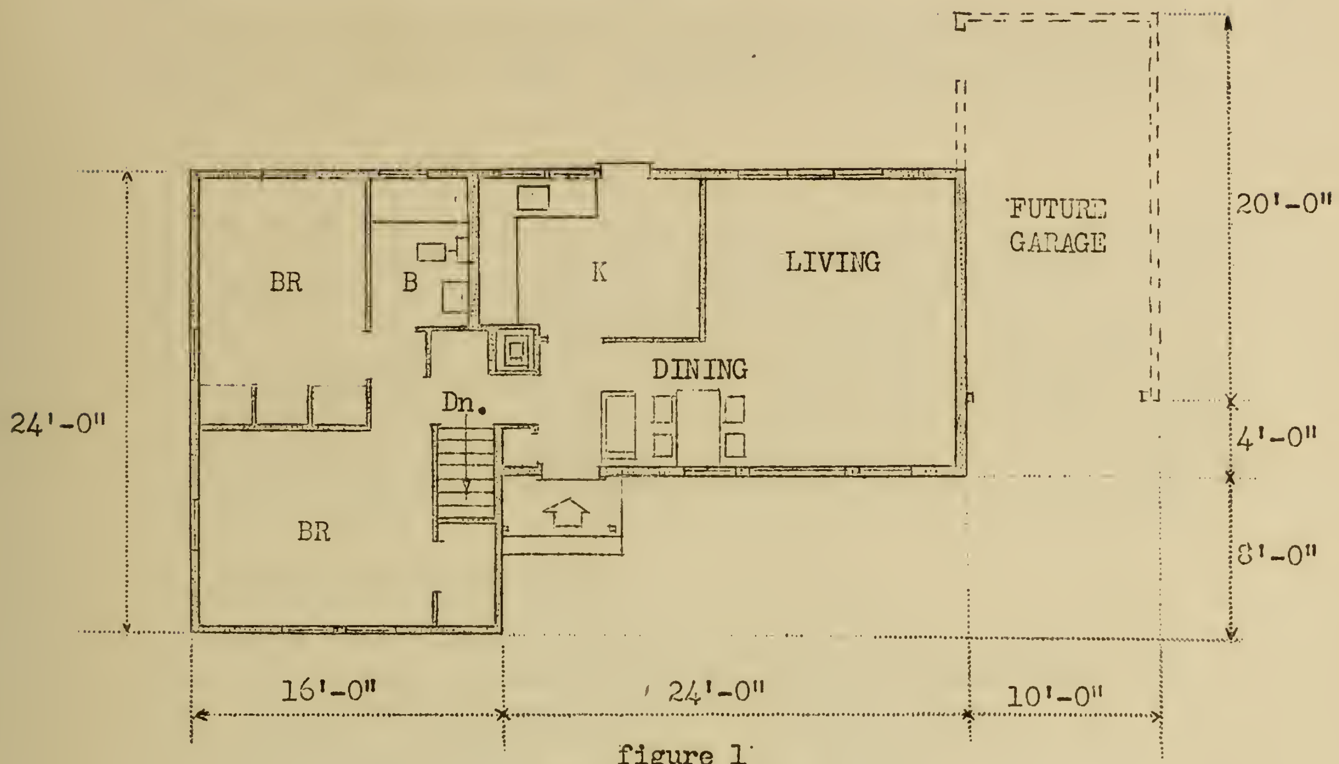

figure 1
FIRST FLOOR PLAN
1/10" = 1'-0"

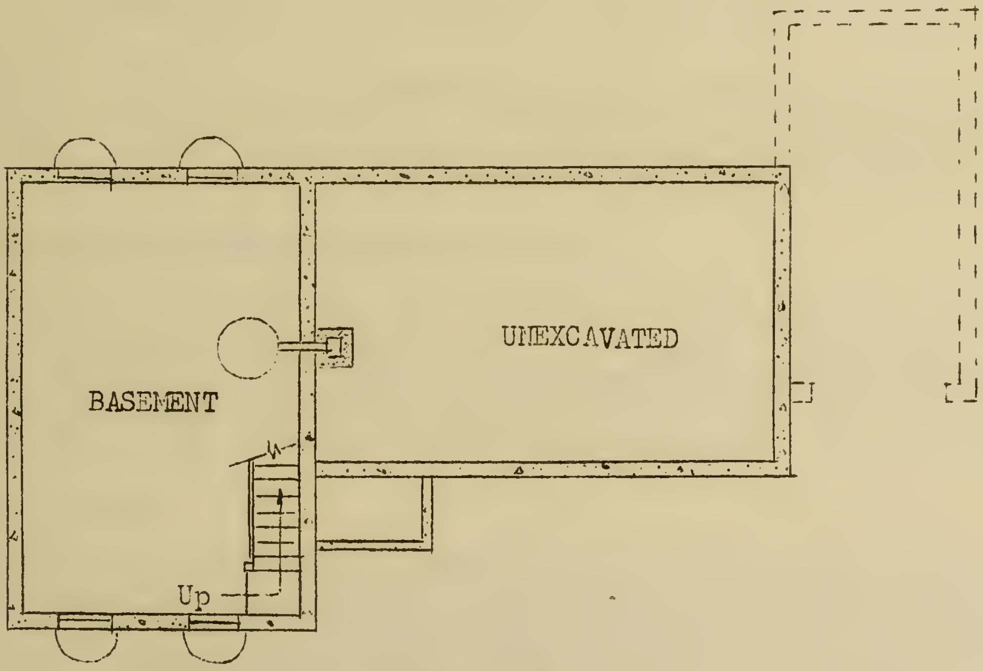

figure 2
BASEMENT FLOOR PLAN
1/10" = 1'-0"

ORIGINAL PLANS INDUSTRY ENGINEERED HOUSE
(prepared by A. Gordon Lorimer, A.I.A.)

### House Not Suitable for Solid Fuel Use

It can be seen that this house was designed without any thought of using coal or coke as a fuel. Examination of these plans shows the following facts:

#### No Provision for Fuel Delivery

Direct truck-to-bin fuel delivery is not possible. A garage was not shown on the original plans, but it was proposed orally that the garage would be attached to the living room end of the house. This position is indicated by dotted lines on the plan. (See figure 1, page 3.) Since the partial basement is located on the opposite end of the house from the location of the future garage, modern, direct solid fuel delivery, using a chute or a conveyor from a truck parked on the driveway, is not possible. Delivery would have to be made by wheeling or carrying, and a special walk would have to be provided for this purpose.

#### No Provision for Ash Removal

Satisfactory ash removal from the basement is not possible. The only access to the basement is via the inside basement stair. Ashes, if carried out, would have to be carried either
(a) through the front hall and out the front door, or
(b) through the kitchen and out the rear door.

## CONSTRUCTION METHODS COMMITTEE MEETING--URBANA, ILLINOIS

On February 28, 1947, the Construction Methods Committee of the Producers' Council, D. T. Colton, (Johns-Manville Corporation), Chairman, met at Urbana to discuss the proposed project of building six Industry Engineered Houses in Urbana as a time-and-motion study.

### Discussion of the House with the Architect

At the close of the meeting, the difficulties of using solid fuel in the L-shaped house were discussed with Mr. Lorimer. At that time, he said no consideration had been given to making provision for the use of solid fuel. The entire design of the house had been based on the assumption that either oil or gas would be used.

#### Fuel Delivery

The difficulty of delivering solid fuel in a satisfactory manner was pointed out to the architect. He agreed that if solid fuel were to be used, and that if the driveway were to be placed in the position which he recommended, the logical position for the fuel storage bin would be under the living room (in the portion of the basement originally designated as unexcavated). This leads to the necessity for a fully excavated basement, since it was considered impossible to change the location of the basement stair, which is in the other section of the basement. With the bin under the living room, proper arrangements for a fuel chute would make it possible to make a direct truck-to-bin delivery.

### Ash Removal

It was pointed out to the architect that the inside basement stair of the house was not suitably located for removing ashes from the basement to the outdoors. Mr. Lorimer said that the layout of the house had been set and the development had proceeded to such an extent that revision of the location of the inside stair was impossible, as this would mean an entirely new house plan.

Since the plan could not be changed, it was obvious that any provision that this project might propose for ash removal would be a "repair" measure and could not correct the original mistake of not planning for solid fuel use. The remedy would have to be in the form of an outside stair, an ash hoist, or some other such measure, which would add to the first cost of the house.

It was proposed to the architect that he consider the use of an "ash-setout areaway." Simply explained, this device consists of a basement window and areaway especially designed and located so that ashes can be set out-of-doors from the basement. The architect agreed that some such scheme might offer one solution to the problem.

## FIRST STUDIES

Subsequent to this first meeting with the architect, studies were made by this project with the idea of offering the most satisfactory possible solution to the problem of providing for solid fuel use in the Industry Engineered Home.

### Proposed Revised Grading Plan

In order to provide for a fuel-delivery window in the foundation wall, it was necessary to revise the original grading layout of the house. Original sketches for the Industry Engineered Home showed that the house was to be set low to the ground. (See figure 3, page 6.) The first floor was located 1'-8" above the existing grade level surrounding the house, thus exposing only 8" of foundation wall on all sides of the house. (FHA regulations require that no wood construction be closer than 8" to finish grade level.) It would be impossible to install a foundation-wall delivery chute in a house so graded. The recommended size for a foundation-wall fuel-delivery chute is 24" high by 32" wide. This chute requires that at least 28" of foundation wall be above the grade line at the delivery point.

Studies for a grading plan for the house showed that it was possible to have the foundation wall exposed 24" to 28" above the ground on the sides and rear of the house, while still maintaining the "close-to-ground" appearance of the house when viewed from the street. This is done by establishing the first floor level of the house 40" above the original ground level, rather than 20" as originally proposed. (See figure 4, page 6.)

# GRADING PLANS
# for the
# INDUSTRY ENGINEERED HOUSE

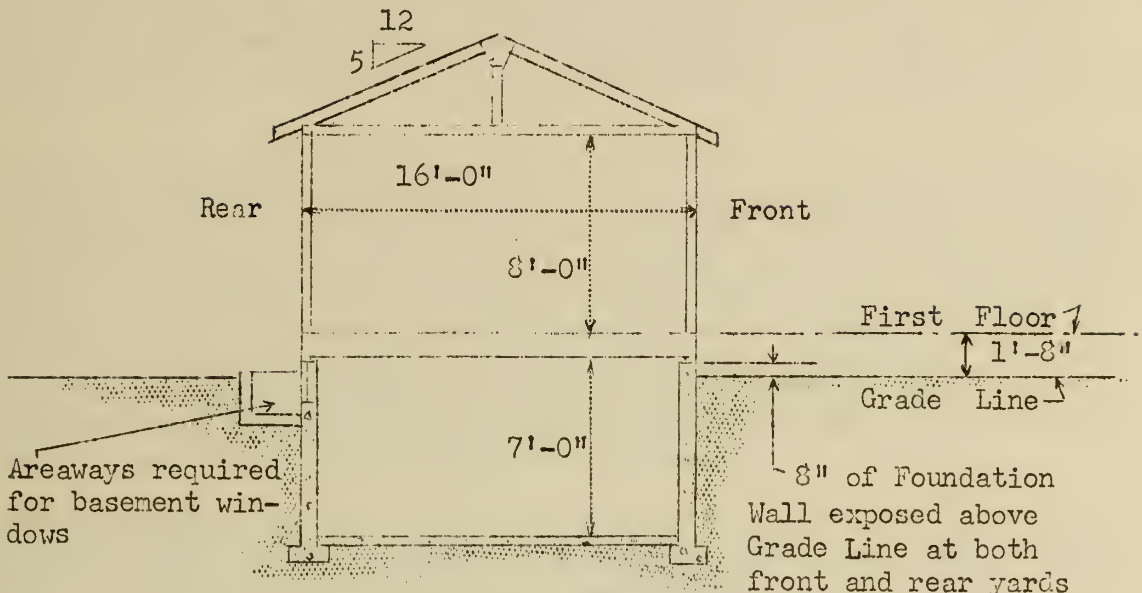
12
5
16'-0"
Rear
Front
8'-0"
First Floor
1'-8"
Grade Line
7'-0"
Areaways required for basement windows
8" of Foundation Wall exposed above Grade Line at both front and rear yards

figure 3
ORIGINAL GRADING PLAN
(by A. G. Lorimer)

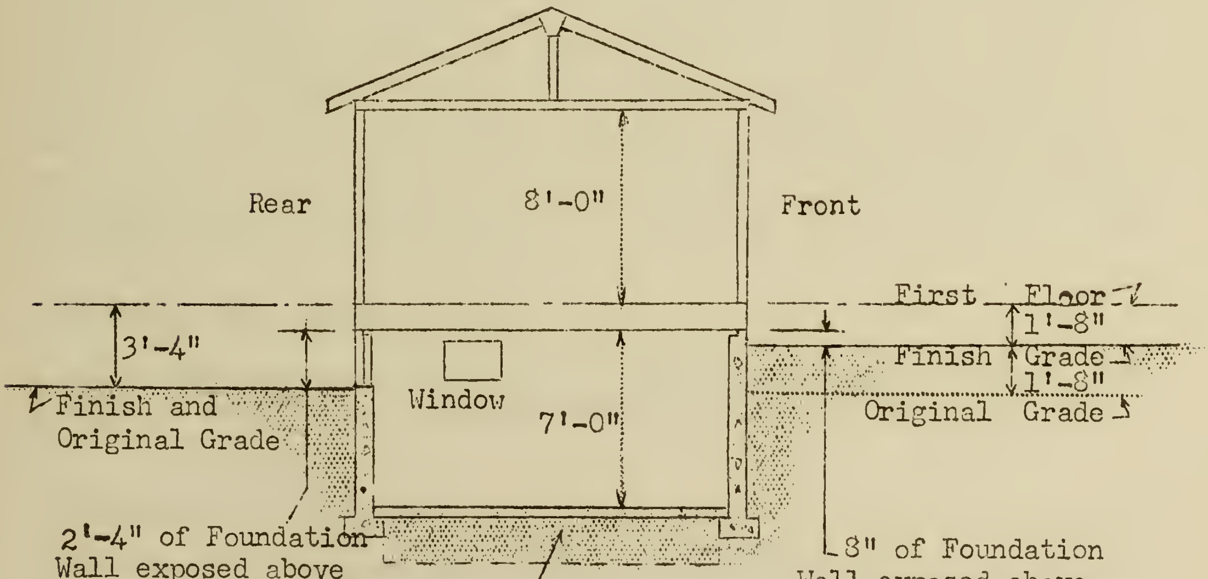
Rear
8'-0"
Front
First Floor
1'-8"
3'-4"
Finish Grade
1'-8"
Window
Finish and Original Grade
7'-0"
Original Grade
2'-4" of Foundation Wall exposed above Finish Grade at the rear and sides of the house--areaways not required for windows
8" of Foundation Wall exposed above Finish Grade at the front of the house
Savings in excavation (47 cu. yds.)

figure 4
PROPOSED REVISED GRADING PLAN
(by Residential Planning Project
Univ. of Illinois)

To keep the "close-to-ground" appearance at the front, the dirt from the basement excavation is spread over the yard in the front of the house, and the front yard grade level is thus raised 20". When graded this way, the house, when viewed from the street, appears to be set as close to the ground as was planned originally, because only 8" of foundation wall are exposed on the front elevation. The other elevations, however, show that 28" of foundation wall are exposed above grade.

By use of this proposed grading plan, the house becomes more economical, because several distinct advantages are gained by exposing more of the foundation wall at the sides and rear. Standard size basement windows may now be placed so they are completely above the ground, thus cutting costs by eliminating the need for areaways at the basement windows. Not only is the expense of construction of the areaways saved, but also the problem of draining and cleaning them is eliminated. With this proposed grading plan, a coal chute 24" high and 32" wide may be placed in the foundation wall entirely above grade, thus making it simple to provide for fuel delivery by conveyor.

Another advantage in the use of this grading layout for the Industry Engineered Home is in the saving in excavation for a house with a full basement -- this saving amounts to approximately 47 cubic yards of earth. Furthermore, since the excavated material may be used for grading the front yard, there is no need to pay for having it hauled away.

The foundation-wall chute is the only inexpensive method of providing for satisfactory fuel delivery to the basement. Other types of chutes, such as grade-line, manhole, etc., are not satisfactory for varying reasons. Grade-line chutes do not require special grading, but require extra effort in delivering the fuel, and are not considered satisfactory by fuel merchants. Bins with a manhole type opening require additional excavation and concrete work under a porch, drive, or elsewhere, and therefore are more expensive. The foundation-wall chute was chosen as being the most satisfactory to fuel merchants and as costing less than other types.

## Proposed Revised Basement Plan

A new basement plan was prepared by this project. The new plan showed a fully excavated basement under the entire house. (See figure 5, page 8.)

### Location of the Fuel Bin

A recommended position for the fuel bin was also shown. This bin was located under the front corner of the living room. This is the only possible location for the bin if deliveries were to be made directly to the bin from a truck on the driveway. The position of the attached garage was moved to a point farther to the rear, in order that the fuel-delivery window might be placed properly in the center of the fuel bin.

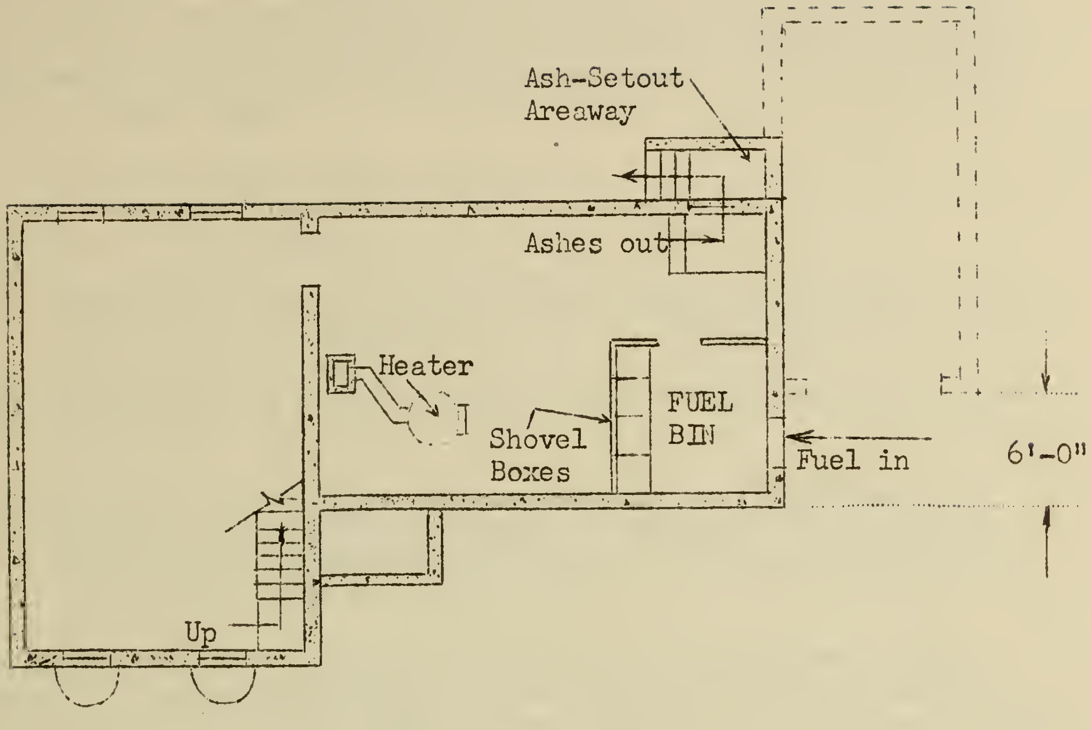

figure 5
PROPOSED REVISED BASEMENT PLAN
(by Residential Planning Project
Univ. of Illinois)

1/10" ≈ 1'-0"

Location of the Heating Unit

In order that the study of the house would be complete, the heating system was studied along with the provisions for the use of solid fuel. For purposes of study, it was assumed that a gravity warm-air system would be used for heating the house, as such a system would be less expensive in first cost than a forced warm-air or a hot water system.

The warm-air heating plant for the house was discussed in a conference with Professor Seichi Konzo of the Mechanical Engineering Department of the University. Professor Konzo suggested that cost of the heating system might be reduced by the use of an extended plenum type of gravity system. This was included in the design.

Another reason for the selection of the gravity warm-air system for the house is that the location of the heating unit is more critical with this system than with any other system, and it was with this fact in mind that the heating unit was placed as shown. This location meets with all the many requirements for the location of the unit as listed below:

(1) Reasonably near to the fuel bin.

(2) Near to the chimney.

(3) Reasonably centrally located with respect to the rooms to be heated, so that no leader pipe is excessively long.

(4) Located so the noise of firing the unit will not disturb the bedrooms.

(5) Located so that the heat loss from the unit itself may be utilized to the best advantage. In the position shown, the heat given off from the unit will help overcome infiltration heat loss through the front door.

The location of the furnace of a forced warm-air system, or the boiler of a steam or hot water system, was not studied in detail, as the location of these units is more flexible. With these systems, the heating unit can be located more or less independently of the rooms to be heated. However, in this particular house, when solid fuel is to be used, the heating unit of either of these systems would have to be in about the same place as the furnace for the gravity system, in order to be located properly with respect to the chimney and the fuel bin.

Proposed Provision for Ash Removal

Studies were made to adapt the ash-setout areaway to this house. The areaway was placed in the rear of the house in a corner formed by the house and the garage. (See figure 5, page 8.) This location was chosen for two reasons:

(1) In this location it would not detract from the appearance of the house as it might if it were located at the front.

(2) With the new grading system, the back of the house was farther out of the ground and the areaway could be built with less expense, as less excavation, concrete work, etc., would be required.

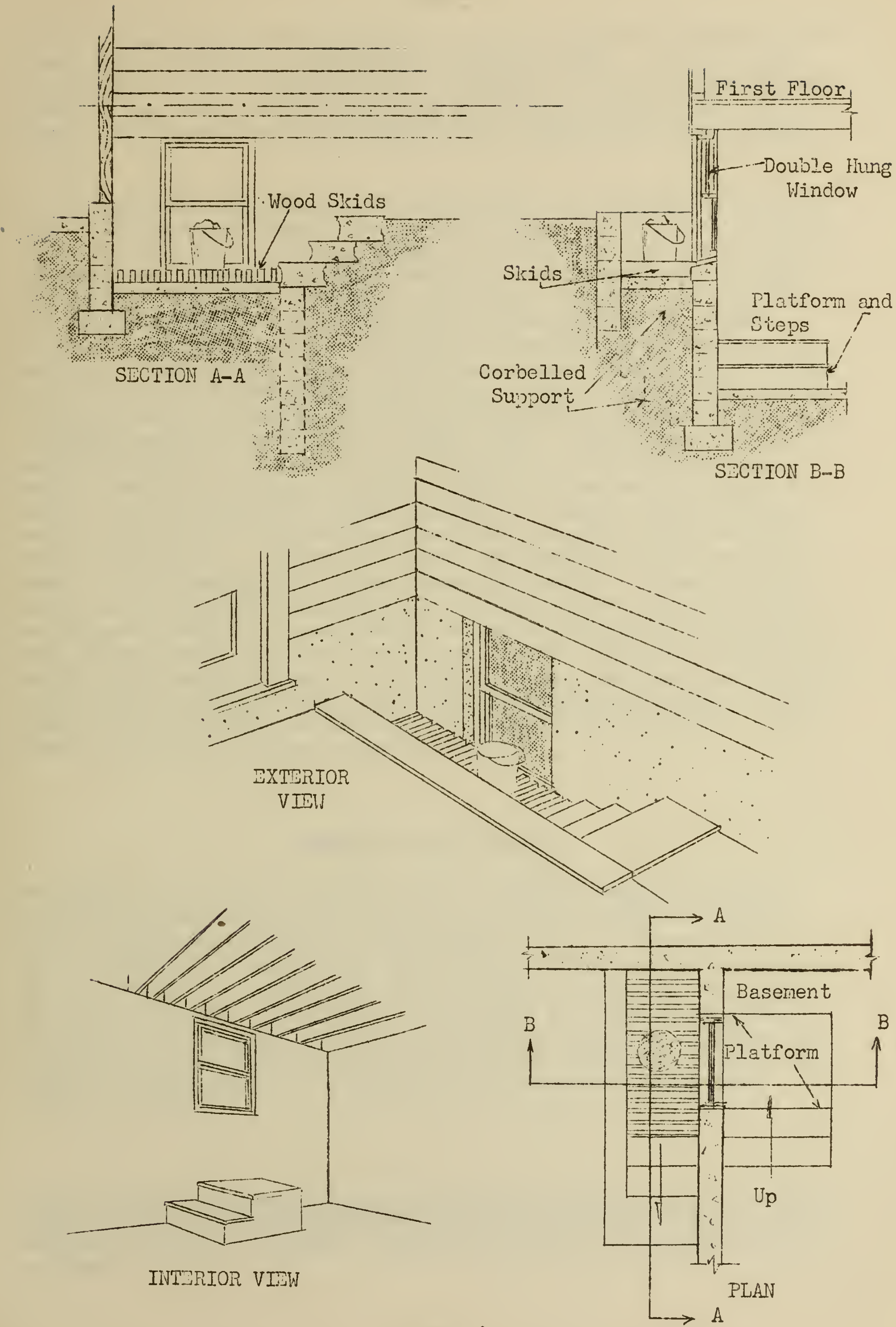

figure 6
ORIGINAL DETAILS OF ASH-SETOUT AREAWAY AT REAR OF HOUSE
(proposed by Residential Planning Project
Univ. of Illinois)

It was proposed that this areaway be built of concrete blocks and the floor of the areaway be paved with a concrete slab. One end of the outside wall of the areaway was to be supported by the garage foundation and the other end by corbelling from the foundation wall of the house. The areaway was to be drained by a connection to the footing drain.*

The opening from the basement to the areaway was designed to be fitted with a double-hung window. This type of window was selected because it is the only one of several standard types which would meet all the requirements. Ordinary wood or steel basement window sash are small and could be used only by setting them low in the wall and carrying the foundation-wall concrete blocks on a lintel above the window. Basement sash are hinged at either the top or bottom and designed to swing in. Sash hinged at the bottom are entirely unsuitable, as they are in the way once they have been opened. Steel casement windows of standard modular sizes do not provide an opening wide enough to handle a basket-shaped ash container of bushel size. Furthermore, the casement's operation is difficult and awkward in this particular space, whether inward or outward swinging. When the sash swings inward, it will be in the way of the person handling the ashes; when the sash swings outward, it will swing against any containers which are in the ash-setout areaway. An ordinary metal fuel-delivery chute was considered, but eliminated as it is almost impossible to push the chute wide open from inside the basement. The double-hung window provides an adequate opening and easy action in opening the sash. The double-hung window, being the most common type used in residential construction, is obtained easily anywhere. The size of window selected is designed to fit into a concrete block wall without cutting any block. It will also fit well in other walls built of masonry units which are coordinated to fit in the 4-inch modular system.

## CONFERENCE WITH SPONSOR

On March 8, 1947, the background of the Industry Engineered House project was explained and the studies shown to Dr. Harold J. Rose, Vice President of Bituminous Coal Research, Inc., in his office. He was agreeable to continuing the study and contacting the architect and the promotors of the house with the view of improving the house for solid fuel use. The problem of adapting the Industry Engineered House was also presented to Mr. Samuel Weiss, Executive Secretary of the American Coke and Coal Chemicals Institute (March 10, 1947), and to Mr. M. R. Grover, Vice President of the Anthracite Institute (March 13, 1947).

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*Footing drains are not needed in all sections of the country. When natural drainage is adequate, special provisions for drainage may be omitted.

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## CONFERENCE WITH ARCHITECT

On March 11, 1947, a conference was held with Mr. Lorimer in his office in New York City. Several problems involved in providing for the use of solid fuel in the Industry Engineered House were discussed during this conference.

### DISCUSSION OF STUDIES AND REVISED PLANS

At this conference, the results of the studies made by this project were shown and explained to Mr. Lorimer. These studies included the proposals explained on the previous pages.

In the meantime, Mr. Lorimer had prepared a new set of drawings showing revisions which were designed to correct the deficiencies of the house with respect to solid fuel use. Mr. Lorimer's revised plans (see figure 7, page 13) included the following changes from his original plans:

(1) A full basement.

(2) A bin for solid fuel.

(3) A proposed location for the heating unit.

(4) An areaway for ash removal located at the front of the house.

Considerable discussion developed concerning both the features proposed on the architect's revised drawings and the proposals advanced by this project.

### Fuel Delivery Discussed

The provision of a fully excavated basement (in place of the partial basement previously shown) made it possible to locate the fuel storage so that it was feasible to deliver fuel directly to the bin from a truck on the driveway. It was pointed out to Mr. Lorimer, however, that it would be necessary to make some change in the grading scheme for the house in order to provide room for a foundation-wall delivery chute. The 8" of the foundation wall above the grade line (as shown on the drawings) was too small to accommodate such a chute. Mr. Lorimer asked about a grade-line type of chute, and it was explained that this type should not be considered due to the fact that fuel merchants find it difficult to use. In order to provide for the foundation-wall chute, a revised grading scheme was proposed to Mr. Lorimer. (See description and illustrations on pages 5, 6, and 7.)

Mr. Lorimer indicated that he would study the pros and cons of this grading scheme, including the possibility of savings to be gained by the reduction in the amount of excavation. (The revised grading scheme, as proposed by this project, was eventually adopted.)

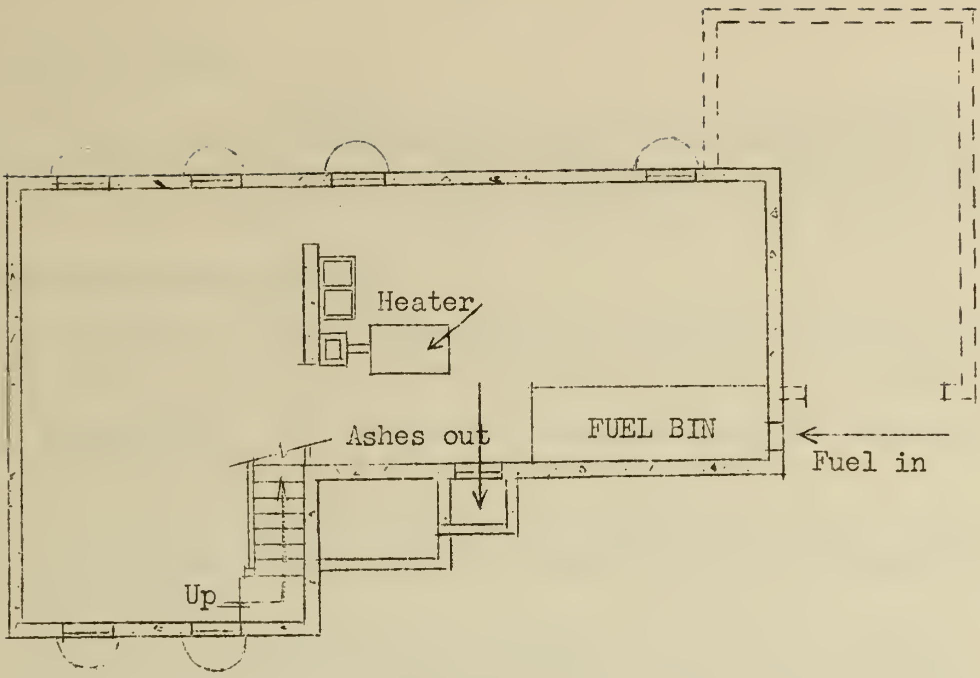

figure 7
REVISED BASEMENT PLAN
(by A. G. Lorimer)

Mr. Lorimer objected to the position of the garage as shown on the revised plan proposed by this project. On this plan, the front of the garage was moved 2'-0" farther back than he proposed. It was explained that this change was made in order to place the fuel-delivery chute more centrally with respect to the bin. Mr. Lorimer felt that a 4-foot set-back of the garage was sufficient, and that no delivery difficulty would arise if the chute were placed in the corner of the bin. (See figure 7.)

Fuel Storage, Heating Unit Discussed

It was recommended to the architect that the shape of the fuel bin shown on his drawings be changed. The bin was too long, front to back, to allow all of the fuel to flow properly to a shovel box at the front of the bin. Mr. Lorimer had made the bin long in order that the shovel box outlet would be near the heating unit, which had been placed very close against the chimney. It was recommended that the bin be made shorter and therefore that the location of the heating unit be revised accordingly, that is, the heating unit would have to be moved farther away from the chimney in order to be close enough to the bin for easy handling of fuel.

## Ash Removal Discussed

Mr. Lorimer's revised drawings showed an areaway for ash removal placed at the front of the house adjoining the entrance stoop. The plans prepared by this project showed an ash-setout areaway in the re-entrant corner formed by the garage and the rear wall of the house.

### Ash-Setout Areaway Location

Several considerations are involved in the selection of the location for an ash-setout areaway. These considerations are as follows:

(1) Convenience. This is probably the most important consideration in the location of the ash-setout areaway.

The areaway should be located so that it is as close to the heating unit as possible, to eliminate excessive carrying in the basement.

The areaway should also be located to save steps outdoors. When the owner is required to carry his ashes to the street curb or to the alley, he wants to carry the ashes for the shortest distance possible.

Where the owner hires a serviceman to remove the ashes, it is still necessary to provide easy access to the ashes for the serviceman. The serviceman should be able to reach the areaway easily without crossing grass or disturbing planting. The depth of the areaway as required by the location should be considered. Deeper areaways require special provision for the removal of the ash container; that is, steps down into the areaway or special hooks for lifting the containers probably would be required.

(2) Economy. Different locations will influence cost by requiring areaways of various depths, with varying amounts of walkway to area, etc.

(3) Appearance of House. Areaways in certain locations are apt to detract from the appearance of the house.

(4) Safety. In some locations, areaways may offer a hazard to children at play, etc.

In view of these points, the two proposed locations were analyzed as outlined on the following pages. The analysis is based on the assumption that the revised grading plan would be followed.*

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*Grade at front of house 20" below first floor, at rear 40" below first floor. (See illustration page 6.)

## Areaway at Front of House

### Advantages

(1) This is a good location with respect to the position recommended for the heating unit.

(2) This is a good location for ease in handling ashes, if the ashes are to go to the street in front of the house or are to be picked up from the driveway.

### Disadvantages

(1) The location in front of the house is not a suitable location if ashes are to be collected at an alley at the rear of the house.

(2) Due to the grading, the areaway at the front of the house must be 20" deeper than one at the rear. (Total depth, 3'-2".)

(3) Due to the depth required, the areaway would be more expensive. Additional steps probably would be required.

(4) Since the areaway is adjacent to the front entrance stoop, it is possible to see directly into the areaway from the entrance stoop. This might be detrimental to the appearance of the house.

(5) With the areaway adjacent to the entrance (see Mr. Lorimer's plans, page 13), there is the danger of a long fall into the deep areaway from the entrance stoop, unless a railing is provided.

## Areaway at Rear of House

### Advantages

(1) Suitable location with respect to the position recommended for the heating unit.

(2) Location at rear is best if ashes are to be taken to an alley at the rear of the house.

(3) The areaway can also be useful for handling garden tools, storm sash, etc. from rear yard to basement.

(4) Grade at rear is lower, therefore areaway is shallower. (Total depth, 1'-6".) Ash containers may be removed more easily and the expense of construction is less.

(5) The areaway is less hazardous because it is less deep.

Disadvantages

(1) If ashes are to be taken to the street in front of the house, it would be necessary to provide a walk around the house. If the garage is attached to the house, the extra distance involved in carrying the ashes around the garage to the street at the front of the house is considerable.

It was recognized that the drainage and removal of snow, water, ice, leaves, etc. would be a problem in either of these locations. Nevertheless, covering the areaway was not considered advisable, as the cover would be large and difficult to handle, and an added expense. Furthermore, a different type of window would have to be selected.

## DISCUSSION OF OTHER POSSIBLE ASH REMOVAL ARRANGEMENTS

A compromise proposal for the location of the ash-setout areaway was discussed. It was proposed that the areaway be located in the small extension of the garage which was intended for storage space, as shown below.

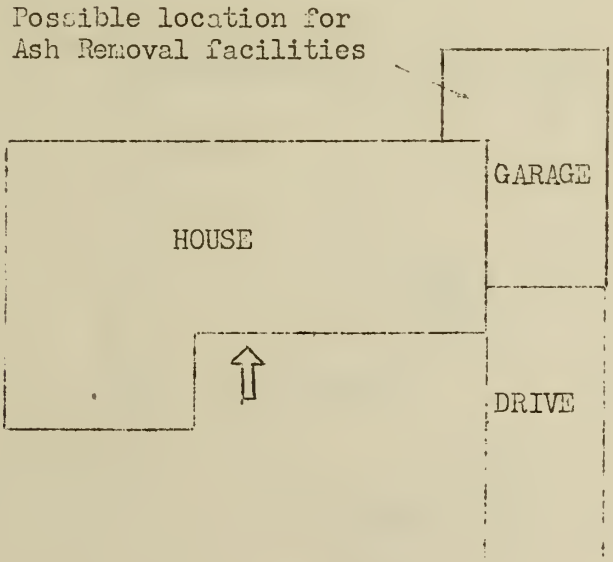


figure 8
SUGGESTED LOCATION FOR ASH-SETOUT AREAWAY

It was thought that this arrangement in the garage would have several desirable features. In this position, it would be unnecessary to provide drainage facilities for the areaway, as it would be under cover. Furthermore, there would be little, if any, dirt blowing into the areaway and the problem of leaves and snow would be eliminated completely. Ashes, if damp, would still be in the garage when set out of the basement into the areaway, and would not freeze. It was agreed that further study should be given the possibility of including the ash-setout areaway as part of the garage structure.

DISCUSSION OF THE INDUSTRY ENGINEERED HOUSE ON NARROW LOT

The fuel-delivery and ash-removal problems arising when the Industry Engineered Home was placed in a rotated position on a narrower lot were also discussed with Mr. Lorimer. He proposed that, in this case, the garage should be attached to the bedroom wing of the house in the location shown in the illustration below. It was agreed that further study should be made on this particular problem.

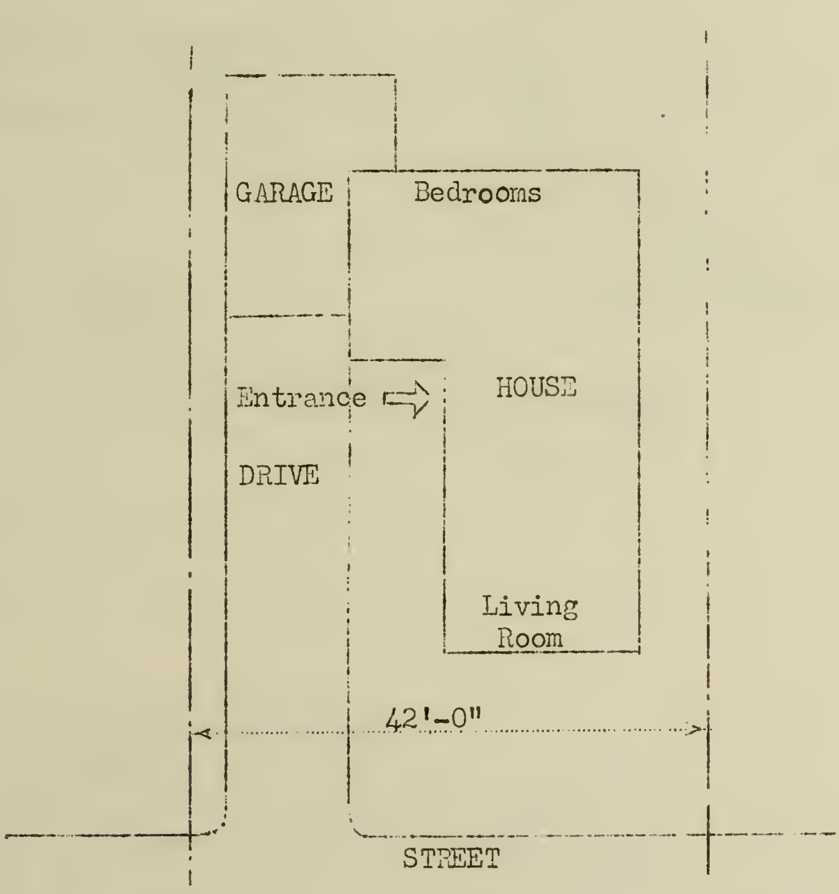


figure 9
LOCATION OF GARAGE -- ROTATED HOUSE
(proposed by A. G. Lorimer)

## NEW STUDIES

### Ash Removal via the Garage

After the March 11, 1947 conference with the architect, studies were made as outlined in the discussion. Two detailed drawings were prepared showing two types of ash-removal schemes in connection with the garage. These details were entitled, (1) "Ash-Setout Areaway in the Garage", and (2) "Basement Entrance in the Garage." These proposals are illustrated below.

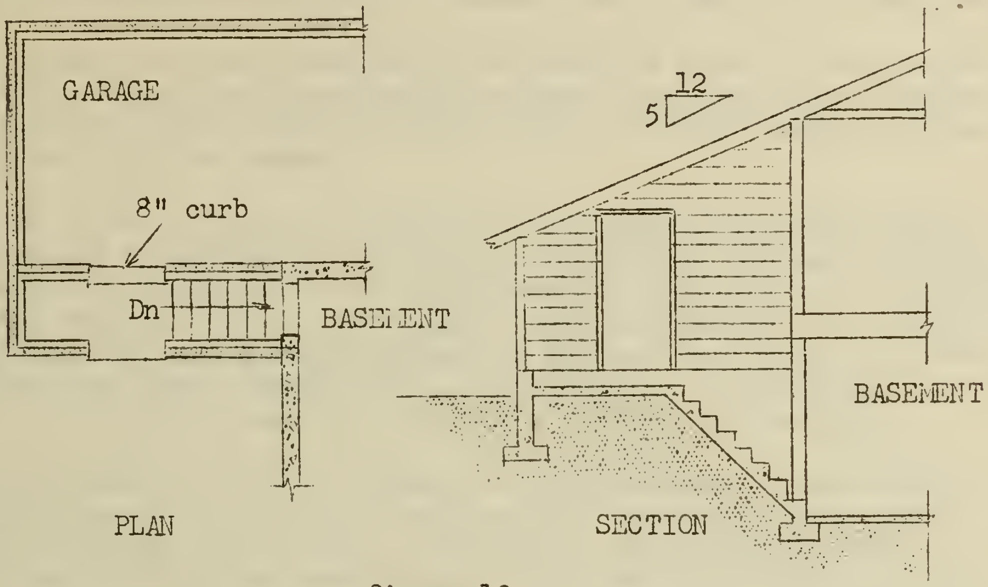


figure 10
BASEMENT ENTRANCE IN THE GARAGE

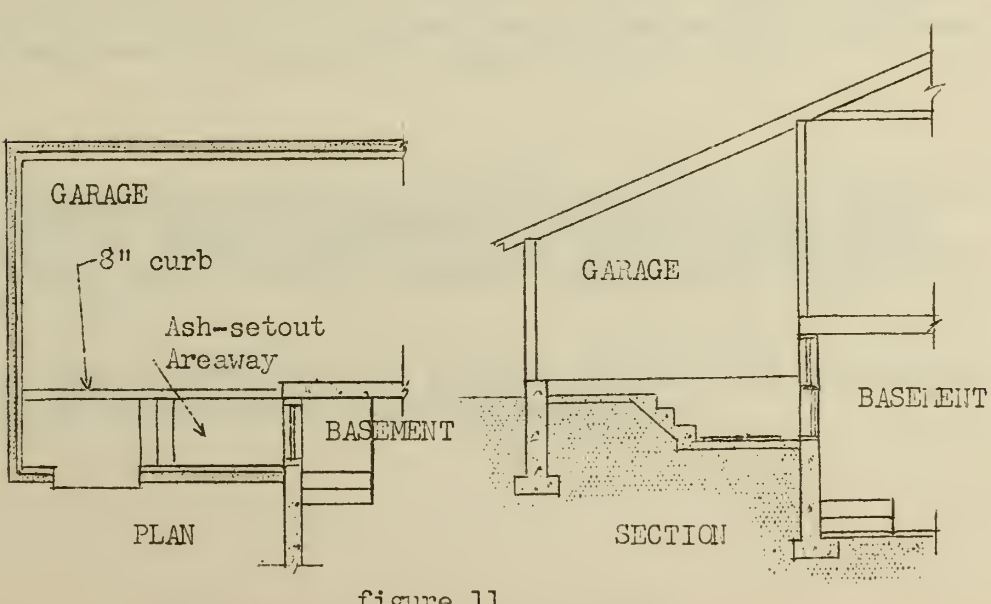


figure 11
ASH-SETOUT AREAWAY IN THE GARAGE

An examination of these details will show that an 8" curb was provided around the ash-setout areaway in the garage and also around the well of the basement stair in the alternate detail. These were provided in an effort to meet the requirements of the Federal Housing Administration regulations, which state, "If door opening occurs between garage and dwelling, the garage floor shall be lower than adjoining floor", and, "Install partition between space containing house heating unit and garage space. Do not install house heating unit in garage space."* Also, the National Board of Fire Underwriters requires that "When doorway connects directly with any room in which there is any direct-fired heating device or gas fixture, it shall have a sill raised at least eight inches above the garage floor level; or the doorway shall lead into a vestibule from which a second door connects with such room."**

It was assumed that this requirement was made in order to prevent the possibility of gasoline fumes settling into a lower area and leaking into the firing room, where they might come in contact with flame and an explosion would be caused.

Blueprints of these details were sent to the Federal Housing Administration Office in Springfield, Illinois, to find out if such arrangements would meet with the approval of their underwriting offices. Quotations from their reply are on the next page. Both schemes were not approved on the basis that ashes would be carried through the garage, and that therefore there was a possibility of an explosion if the garage were filled with gasoline fumes and live coals remained in the ashes.

Due to this ruling, it was necessary to eliminate the consideration of the ash-removal scheme in connection with the garage when passage through the garage was required. Therefore, this study for the Industry Engineered House was dropped. It should be pointed out that strict adherence to this ruling will handicap many other plans where ash removal could be handled readily through the garage. Many homes have been built in which ashes are handled this way. Obviously no hazard exists if due caution is exercised by allowing the ashes to become cold before they are carried out through the garage.

As can be seen from the reply of the FHA, no direct ruling was made as to whether or not the 8" curb, as shown in the details, would meet with the requirements of the code as quoted above.

---

*Minimum Property Requirements for Properties of One or Two Living Units, (State of Indiana), published by the National Housing Agency, Federal Housing Administration, September, 1946; section 419-A, paragraphs 2 and 3.

**Building Code recommended by The National Board of Fire Underwriters, New York, 1943 Edition; section 1305, paragraph 2-d.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

---

[illegible]

[illegible] by the National Board of Fire [illegible]

Excerpts from a letter from the Office of the District Director of the Federal Housing Administration, Springfield, Illinois:

> "In reply to your letter of March 31st, 1947, in which you enclosed a detail of 'Ash-Set-Out Areaways' and detail of 'Grade Entrance in Garage', please be advised as follows: Section 318-A-3 of the Property Standards and Minimum Construction Requirements states; 'Do not install house heating unit or other fuel burning appliance in garage space. Install partition between space containing house heating unit and garage space.' It is considered inadvisable to handle ashes or cinders which conceivably could contain live coals in a garage space occupied by a car in which gasoline is stored. The gasoline tank or carburetor could spring a leak, fill the garage with fumes and cause a fire or explosion.
>
> "In view of the above facts, safety from fire hazard necessitates the removal of the house heating equipment from the garage area. We feel the handling of ashes or cinders in a space occupied by a car or open to an area occupied by a car should be discouraged."

## FURTHER STUDIES

### "SUGGESTED DETAILS FOR SOLID FUEL HEATING"

Further studies were made in view of offering a final recommendation to the Producers' Council and the National Retail Lumber Dealers Association for handling fuel delivery and storage, and ash removal, in the L-shaped Industry Engineered House. The results of these studies were incorporated in a sheet of drawings entitled "Suggested Details for Solid Fuel Heating." Blueprinted copies of this sheet were submitted to the sponsors of this project by letter dated May 2, 1947, and comments were requested. The material on the blueprint has been reproduced in mimeographed form for this report.

"Suggested Details for Solid Fuel Heating" included the following items:

(1) House in Normal Position (2 plans, 2 elevations).
(pages 20A through 20B of this report)

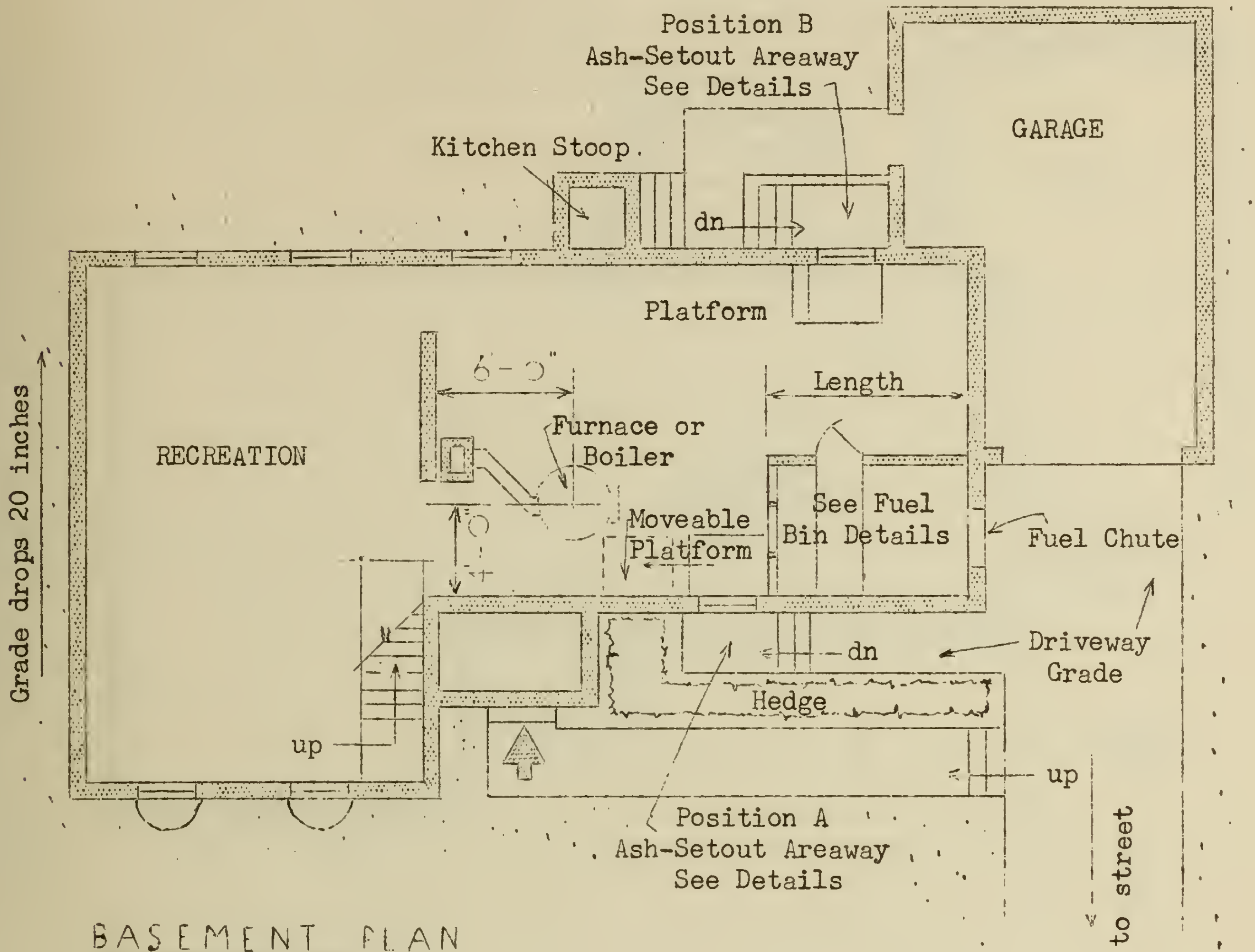
(2) House in Rotated Position (2 plans, 2 elevations).
(pages 20C through 20D of this report)

(3) Details: Ash-Setout Areaway (plan and 2 sections).
(pages 20E through 20F of this report)

(4) Detail: Solid Fuel Bin with Shovel Boxes (plan and section).
(pages 20G through 20 H of this report)

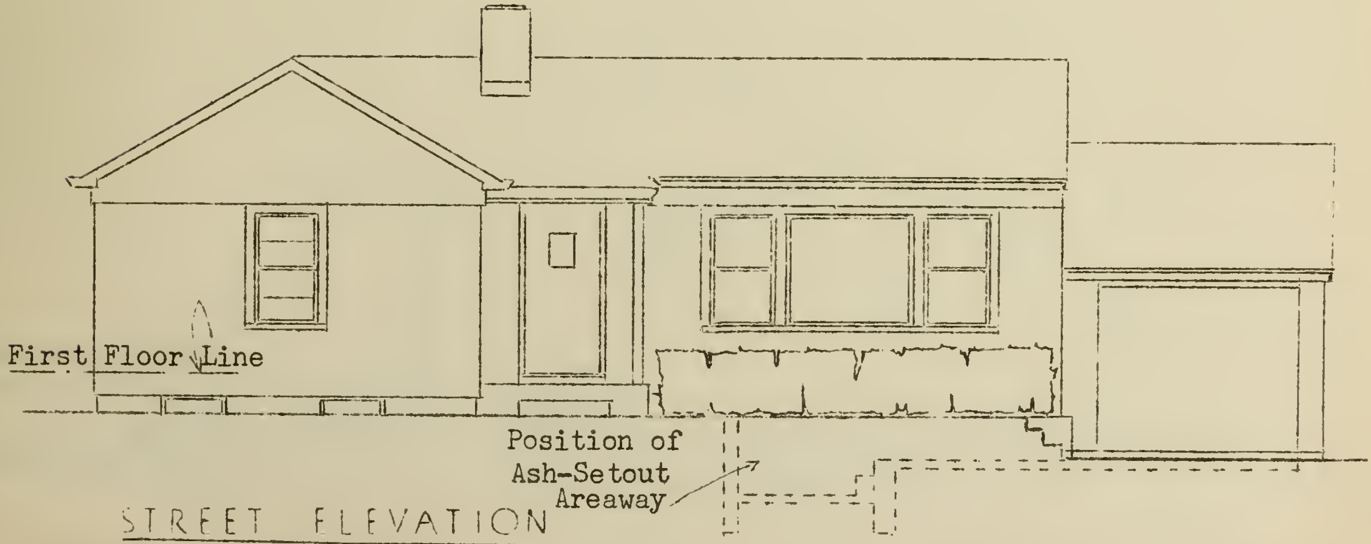
These items will be discussed in order.

# NORMAL POSITION — FOR WIDE LOTS



BASEMENT PLAN

Scale: 1/8" = 1'-0"

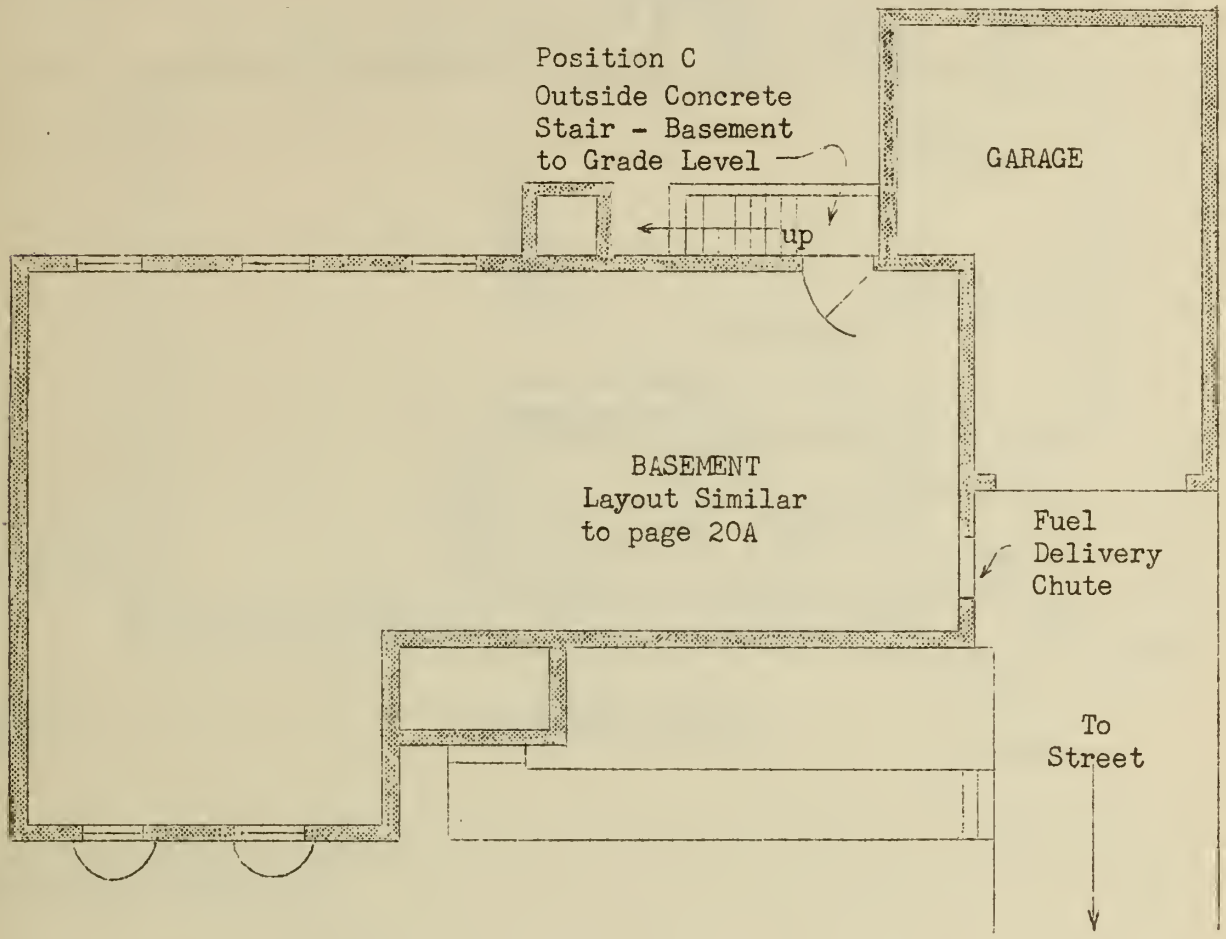


STREET ELEVATION

Scale: 1/8" = 1'-0"

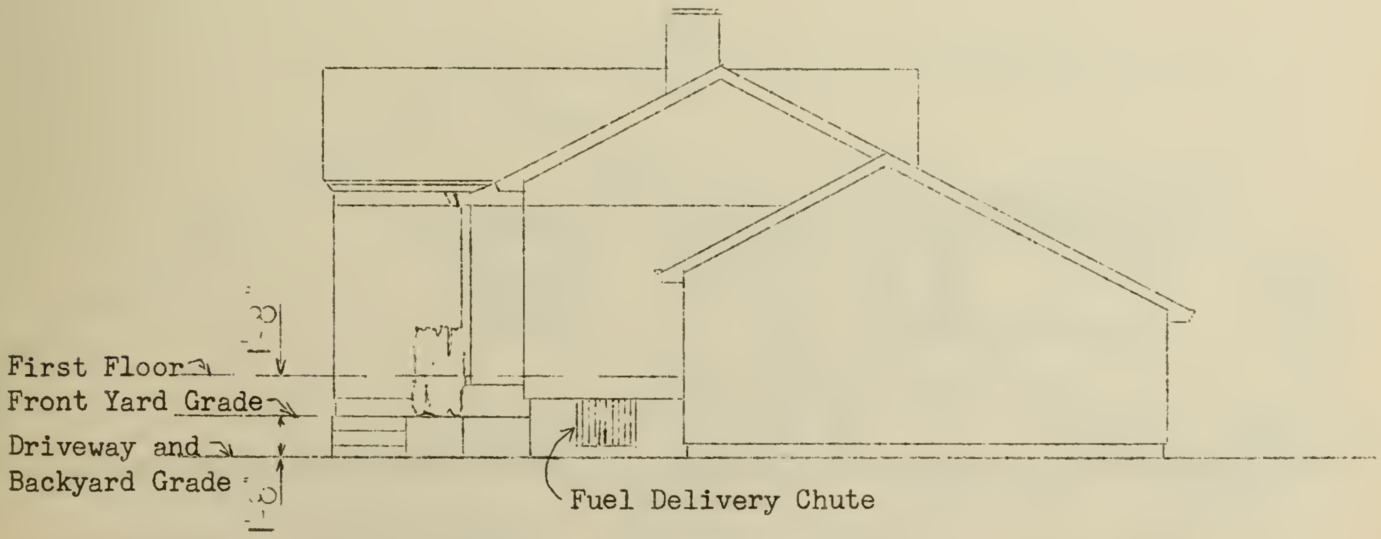
From "Suggested Details for Solid Fuel Heating"

# NORMAL POSITION — FOR WIDE LOTS



BASEMENT PLAN

Scale: 1/8" = 1'-0"

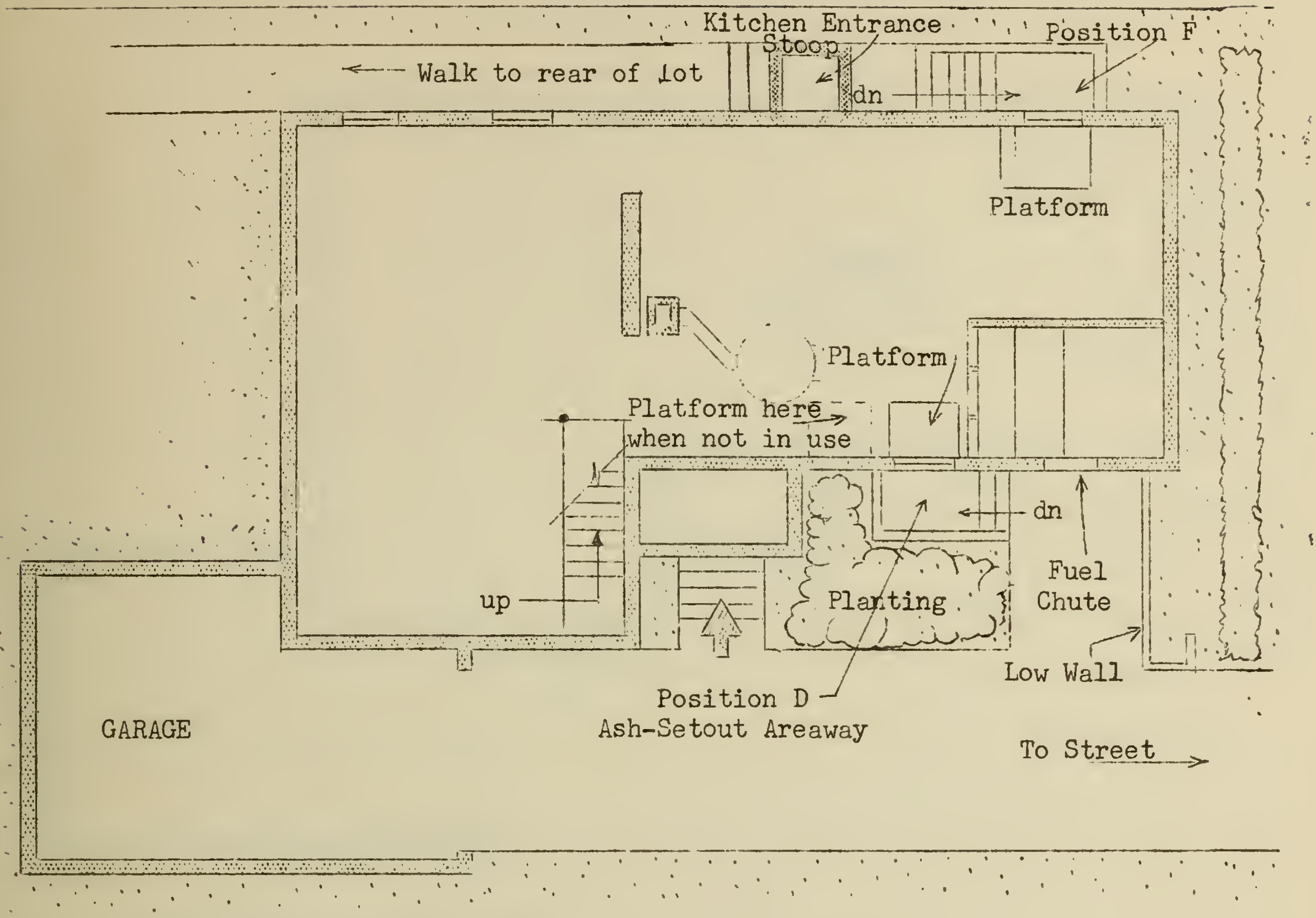


SIDE ELEVATION

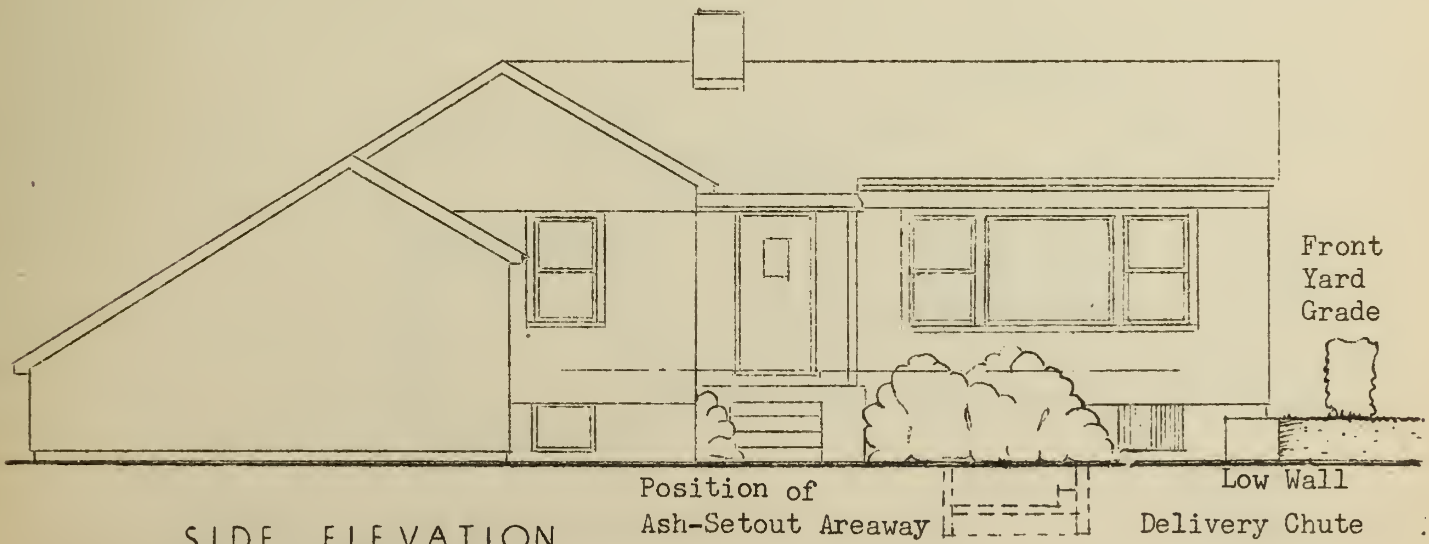
Scale: 1/8" = 1'-0"

From "Suggested Details
for Solid Fuel Heating"

# ROTATED POSITION — FOR NARROW LOTS



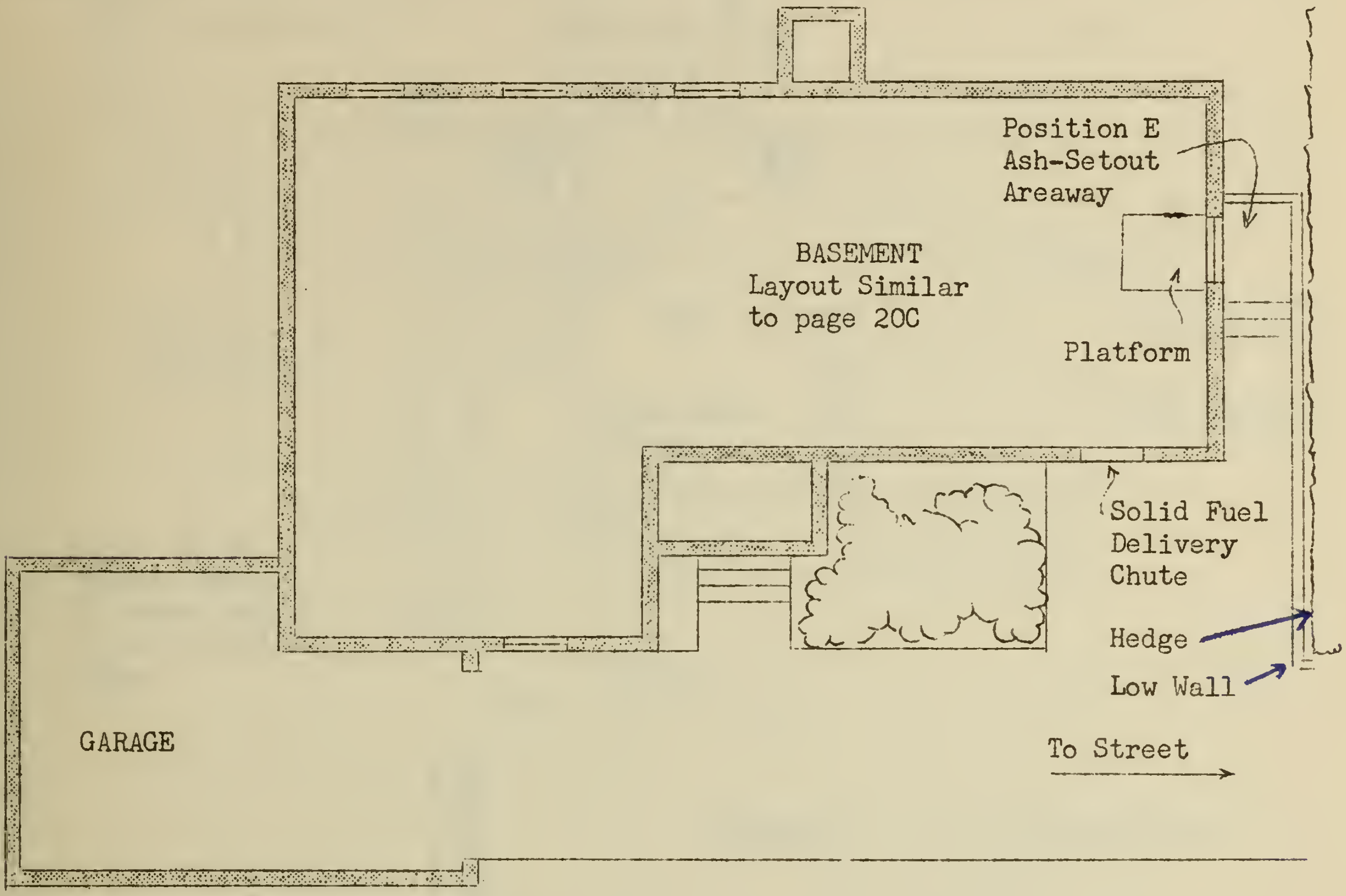
BASEMENT PLAN
Scale: 1/8" = 1'-0"



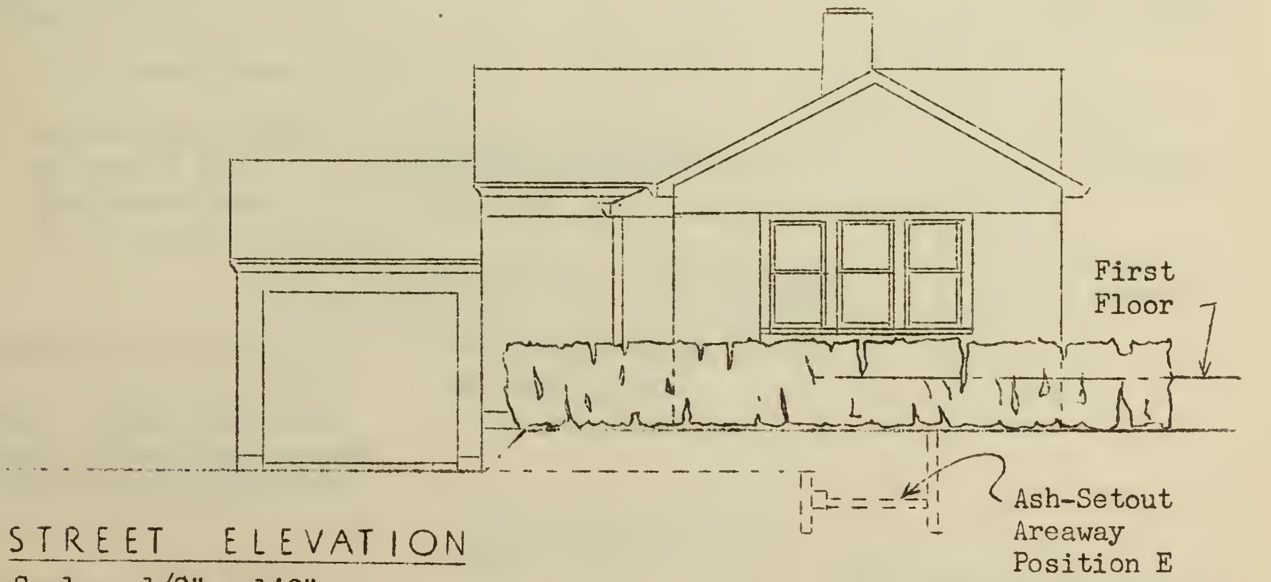
SIDE ELEVATION
Scale: 1/8" = 1'-0"

From "Suggested Details
for Solid Fuel Heating"

# ROTATED POSITION — FOR NARROW LOTS



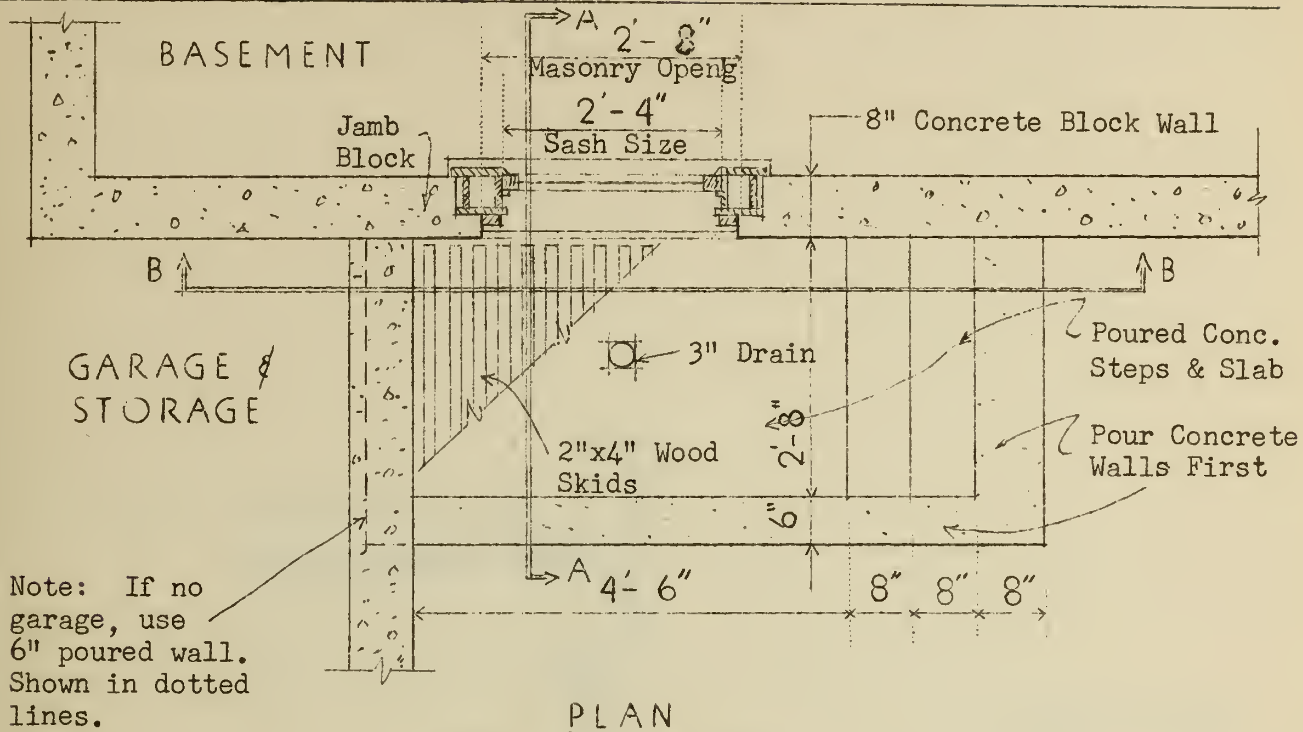
BASEMENT PLAN
Scale: 1/8" = 1'-0"



STREET ELEVATION
Scale: 1/8" = 1'0"

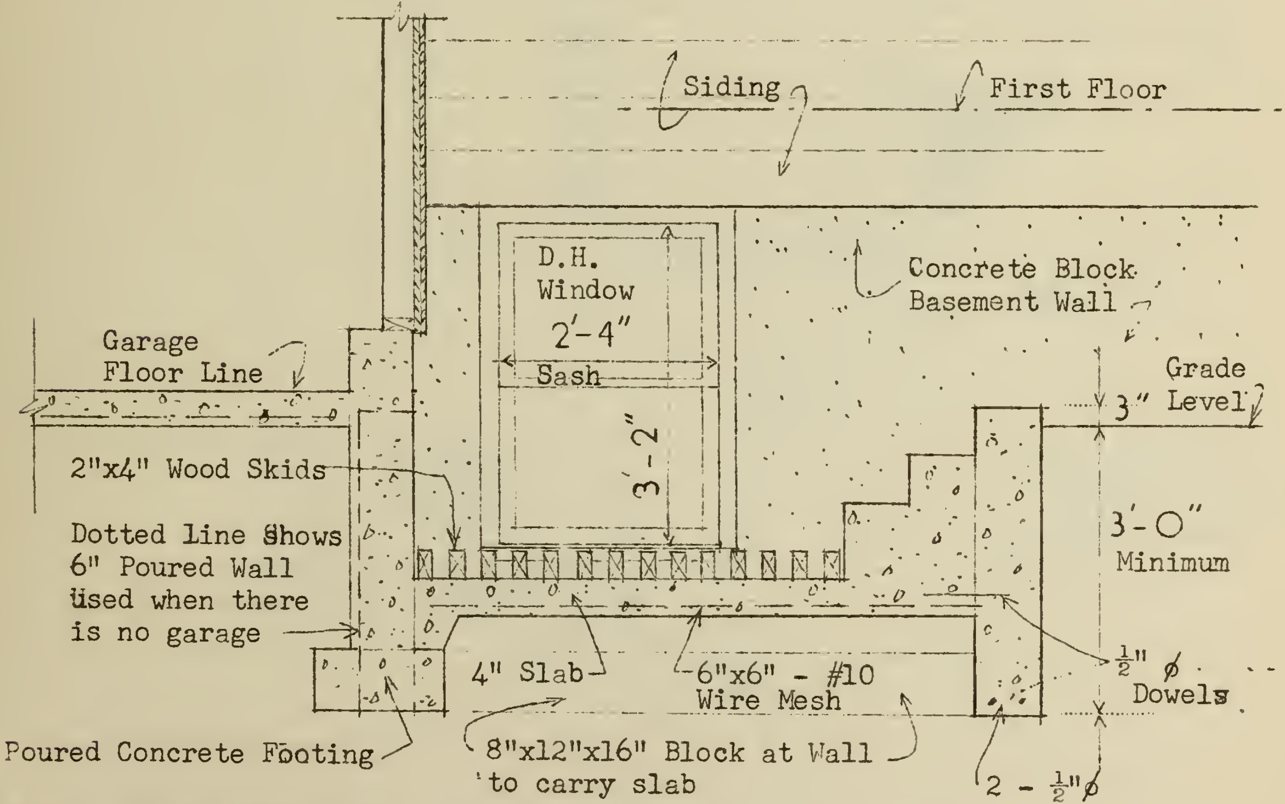
From "Suggested Details
for Solid Fuel Heating"

# DETAILS: ASH-SETOUT AREAWAY



Note: If no garage, use 6" poured wall. Shown in dotted lines.

PLAN
Scale: 1/2" = 1'0"



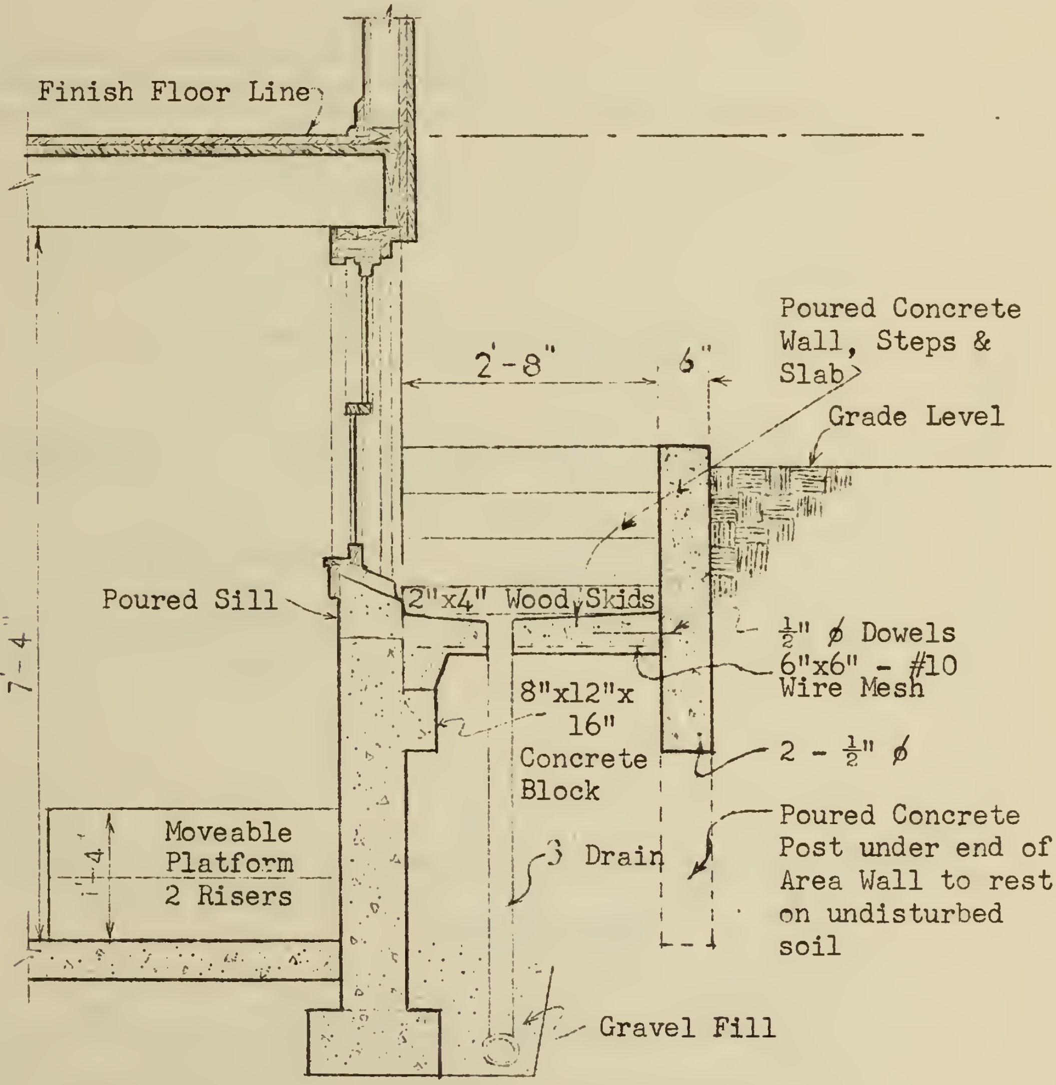
Dotted line Shows 6" Poured Wall used when there is no garage

Note: Adjust number of risers to depth of areaway. Risers not to exceed 8".

SECTION B-B
Scale: 1/2" = 1'-0"

From "Suggested Details for Solid Fuel Heating"

# DETAILS: ASH-SETOUT AREAWAY



SECTION A-A

Scale: 1/2" = 1'-0"

From "Suggested Details for Solid Fuel Heating"

[illegible]

[illegible]

[illegible]

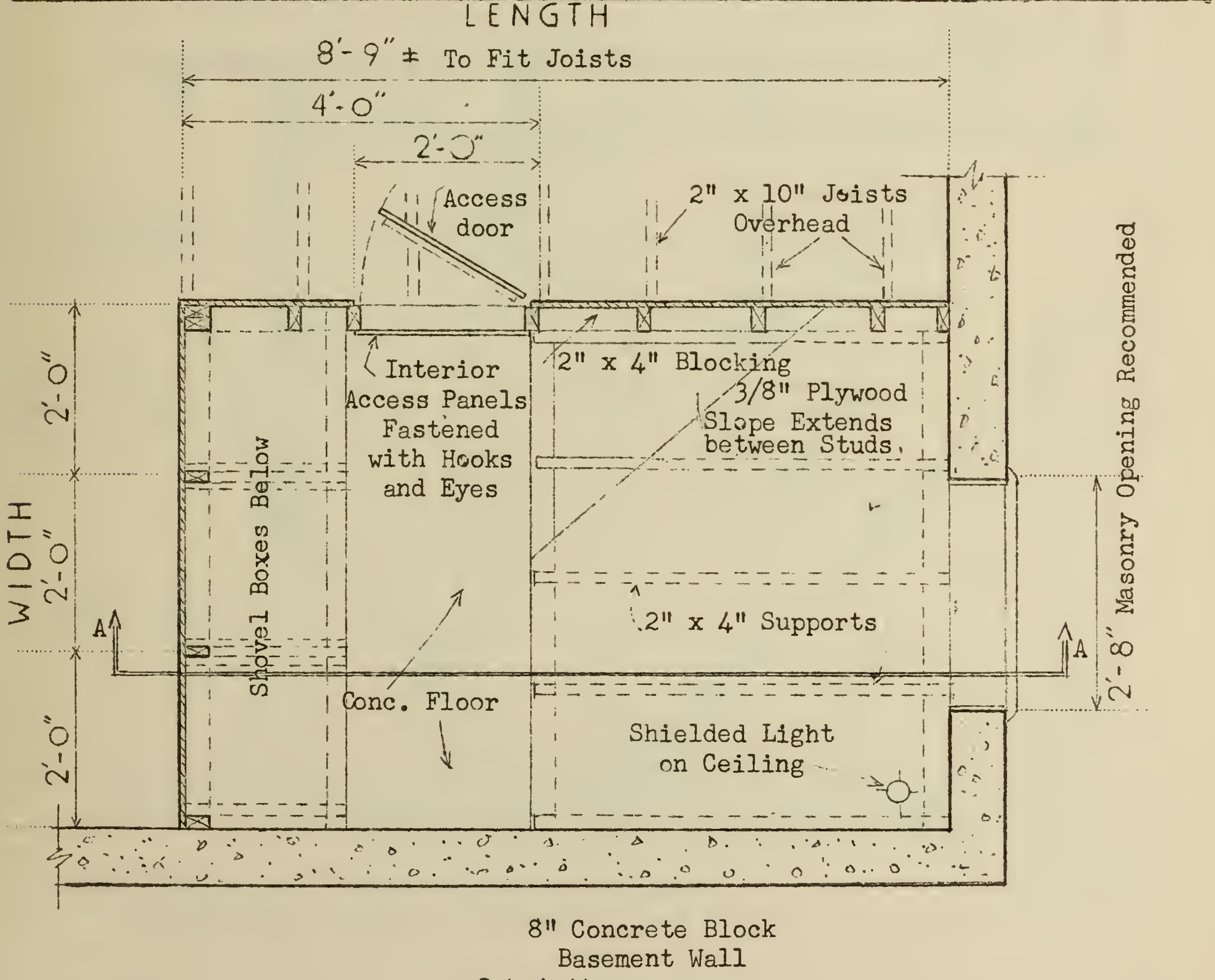
## CAPACITY OF BIN

(Filled Level to 5'-0" High)

| WITH SLOPING BOTTOM | | | | | SOLID FUEL | | WITHOUT SLOPING BOTTOM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DIMENSIONS | | | | | | | DIMENSIONS | | | |
| 6'-0" x 8'-9" | | 8'-0" x 8'-9" | | Angle of Slope | *TYPE | **Cubic feet per ton | 6'-0" x 8'-9" | | 8'-0" x 8'-9" | |
| Tons | Vol. (c.f.) | Tons | Vol. (c.f.) | | | | Tons | Vol. (c.f.) | Tons | Vol. (c.f.) |
| 3 3/4 | 170 | 3 | 227 | 45° | B | 45 | 5 | 231 | 6 3/4 | 308 |
| 5 | 188 | 6 3/4 | 251 | 37° | A | 37 | 6 1/4 | 234 | 8 1/3 | 312 |
| 2 2/3 | 188 | 3 1/2 | 251 | 37° | C | 70 | 3 1/3 | 234 | 4 1/2 | 312 |

* A = Anthracite B = Bituminous C = Coke

**Tonnage capacities are based on these figures which vary considerably with source of fuel


LENGTH
8'-9" ± To Fit Joists
4'-0"
2'-0"
Access door
2" x 10" Joists Overhead
2" x 4" Blocking
3/8" Plywood Slope Extends between Studs
Interior Access Panels Fastened with Hooks and Eyes
Shovel Boxes Below
WIDTH
2'-0"
2'-0"
2'-0"
A
A
2" x 4" Supports
Conc. Floor
Shielded Light on Ceiling
2'-8" Masonry Opening Recommended
8" Concrete Block Basement Wall

PLAN

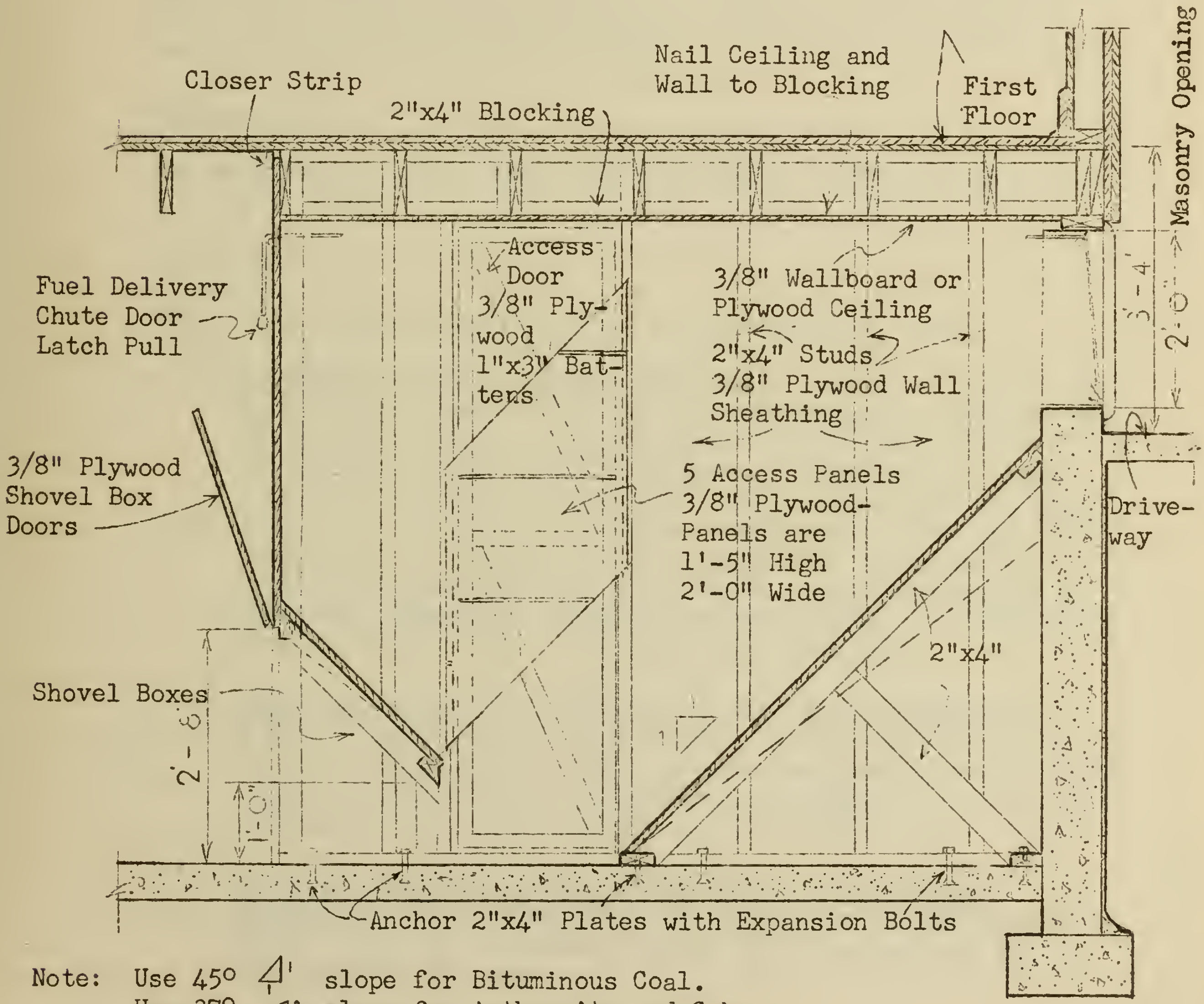
Scale: 1/2" = 1'-0"

## DETAIL - SOLID FUEL BIN WITH SHOVEL BOXES

For Use with Hand-Fired Heating Units or Hopper Feed Stokers

From "Suggested Details for Solid Fuel Heating"

# DETAIL - SOLID FUEL BIN WITH SHOVEL BOXES


Closer Strip
2"x4" Blocking
Nail Ceiling and Wall to Blocking
First Floor
Masonry Opening
Access Door 3/8" Plywood 1"x3" Battens
Fuel Delivery Chute Door Latch Pull
3/8" Wallboard or Plywood Ceiling
2"x4" Studs
3/8" Plywood Wall Sheathing
3'-4"
2'-0"
5 Access Panels 3/8" Plywood- Panels are 1'-5" High 2'-0" Wide
3/8" Plywood Shovel Box Doors
Drive-way
2"x4"
Shovel Boxes
2'-6"
1'-0"
1
Anchor 2"x4" Plates with Expansion Bolts

Note: Use 45° ⊿ 1' 1 slope for Bituminous Coal.
Use 37° ⊿ 3 4 slope for Anthracite and Coke.

SECTION A-A

Scale: 1/2" = 1'0"

From "Suggested Details
for Solid Fuel Heating"

House in Normal Position

The width of the house is 40'-0". When a garage is attached on the living room end, the total width is 50'-0". With side yards as specified by FHA (3'-0" on attached garage side, 5'-0" on bedroom side)*, this house requires a 58'-0" lot.

Fuel Delivery and Fuel Storage

The fuel storage arrangement proposed in the first studies made by this project (see page 7) were followed in the final layout. The plans show a full basement with a fuel bin under the living room located so that a direct truck-to-bin delivery can be made from the driveway. The fuel-delivery chute is in the foundation wall just forward of the garage. The revised grading layout previously recommended by this project (see pages 5,6, and 7) was also shown on the final layout.

Heating Unit

The location of the heating unit is shown as previously proposed by this project.

Ash Removal

Three alternatives were offered for the removal of ashes.

(1) Areaway at Front of House--Position A. In this proposal the ash-setout areaway was placed at the front of the house, but set farther away from the entrance stoop than shown by Mr. Lorimer in his revised drawings. This areaway is of necessity a deeper areaway than that proposed for the rear, due to the fact that the finish grade line at the front of the house is 20" higher than at the rear. Considerably more expense is involved, as a paved, depressed walkway is provided between the driveway and the areaway. This may be seen in detail in the accompanying illustration.

(2) Ash-Setout Areaway at the Rear of the House--Position B. This alternate shows an ash-setout areaway to the rear of the house in a corner formed between the garage and the house proper. This areaway is much less expensive, as it is not so deep and a special walkway is not required.

(3) Outside Basement Stairway at the Rear of the House--Position C. The third alternate shows an outside basement stair placed in the corner formed by the garage and the rear wall of the house.

---

*Property Standards and Minimum Construction Requirements (for dwellings located in Illinois), published by the Federal Housing Administration, Springfield, Illinois, April 15, 1942; section 206, page 5.

Of these various alternates, it is recommended that either of the two at the rear of the house be used whenever feasible. When ashes are to be carried to the street, the ash-setout areaway at the front of the house probably will be the most convenient.

Another excellent alternative is shown in the illustration below. In this plan, a basement stair is placed at the end of the house between the living room and the garage. In this position the stair would be covered, and would meet with all fire and building regulations. This scheme was not shown on the blueprint because it requires a lot greater than 60'-0" wide. The architect felt that this house should not be designed so that a lot wider than 60'-0" would be required.

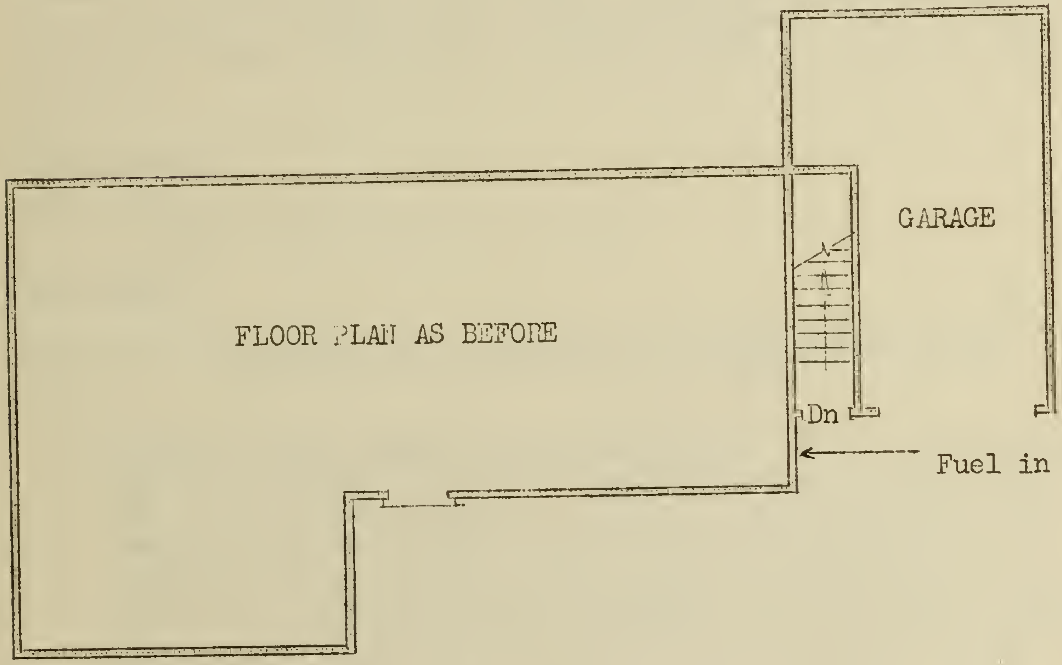


figure 12
FIRST FLOOR PLAN
showing
BASEMENT STAIR BETWEEN GARAGE AND HOUSE

[illegible]

[illegible]

[illegible]

## House in Rotated Position

The width of the house is 24'-0". When a garage is attached on the bedroom wing per Mr. Lorimer's specification, the total width is 34'-0". With side yards as specified by FHA, a lot 42'-0" wide is required by this house.

### Fuel Delivery

The delivery of fuel for the rotated house is very awkward. The fuel bin is located as before, but the driveway is 8'-0" away from the nearest wall of the bin. (See pages 20C & 20D.) Since this is the only point where fuel delivery from the driveway is possible, it is necessary to lower the finish grade at this point in order to accommodate a foundation-wall chute. This means the grade at the chute and the grade of the driveway will be 40" below the first floor of the house, or 20" below the grade at the front of the house. Unfortunately the arrangement is such that the driveway serves also as the front entrance walk to the house. Five steps will be required between the driveway and the entrance stoop. This difference in grade lines will result in the house appearing high and awkward when viewed from the driveway (and entrance) approach. The solution is not satisfactory, although the appearance from the street is satisfactory.

### Heating Unit

The heating is shown located as before.

### Ash Removal

Three alternate locations are shown for the ash-setout areaway. No one of these locations is entirely satisfactory.

(1) Areaway near Entrance Stoop--Position D. The first alternate shows an areaway placed in a similar position to Position A. The illustration shows the portion of the lot between the driveway and the house at the level of the driveway. This allows room for a shallow areaway and the fuel delivery chute, but also requires the expense of constructing a small retaining wall in line with the front of the house to retain the higher grade of the front yard. This grading scheme means that three additional steps, making a total of five, are required for the entrance stoop, and the house has an awkward appearance from this angle.

(2) Areaway at Street Front of House--Position E. The grading scheme is similar to the previous alternate in that the grade between the front of the house, the entrance stoop, and the driveway, is kept to the driveway level. The ash-setout areaway is moved to the street front of the house, thus eliminating the undesirable view of the areaway from the front

entrance stoop and allowing a better opportunity for landscaping around the front entrance. The expense is still considerable, as a deeper areaway and more retaining wall is required.

(3) Areaway on Kitchen Side of House--Position F. The ash-setout areaway in position F is suitable only when ashes are to be taken to the rear of the house (unless a special walk is provided from the areaway to the front street). As shown on the print, more steps are required down into the areaway because the grade of the lawn at this point is higher. It would be possible to lower the grade of the lawn at this point, but a higher stoop would have to be provided at the kitchen door.

Details: Ash-Setout Areaway

It was decided that the areaway walls could be constructed of poured concrete more easily than of concrete blocks. Details of the wall and slab are shown. A double-hung window was used for reasons previously explained. A grille of 2" x 4" members laid on edge is shown. These members are intended to aid in setting the ash containers out into the areaway by serving as skids.

Steps leading down into the areaway are shown. These need not be provided where the areaway is relatively shallower, or when hooks are provided for lifting containers out of deeper areaways.

Detail: Solid Fuel Bin with Shovel Boxes

The bin details shown were developed from Bulletin No. M-3 published by the Anthracite Industries, Inc. (now the Anthracite Institute). The bin shown is of 2" x 4" studs and 3/8" plywood construction. A masonry bin would also be suitable.

## COMMENTS

Representatives of the sponsors replied to the request for comments on the blueprinted sheet of details titled "Suggested Details for Solid Fuel Heating." Their comments are quoted below. (Portions of the letters which do not pertain particularly to this sheet of drawings are omitted.)

From Mr. M. R. Grover (Anthracite Institute), letter dated May 28, 1947:

> "I have checked the blueprints of the house sponsored by the Producers' Council of the National Retail Lumber Dealers Association with several members of our organization who consider the design work well done.
>
> * * * * *
>
> "We agree with the recommendation of a coal bin with sloping side which permits the shoveling of all coal from the bin through the shovel box entrance, but on the other hand we have no objection to the flat bottom bin which keeps the cost of the bin construction at a lower level and also permits a greater storage and a reserve at the bottom of the bin against a period when it might not be convenient for the dealer to make fuel delivery."

From Mr. C. E. Shaffer (American Coke and Coal Chemicals Institute), letter dated May 23, 1947:

> "I have the following comments on the proposed plans for the 'Industry Engineered House.'
>
> "Several people to whom I have shown the plans do not like the ash set-out areaway in front of the house. Admittedly, the surrounding hedge or shrubbery will hide it from the street, yet it will be visible from the front porch or stoop and will not be a delectable sight. Also, I am wondering about keeping the areaway clean. Actually, it is a pit below ground level and will be a natural collecting place for leaves and other debris carried by winds. The 2 x 4 skids in the bottom of the pit will make it difficult to clean and if the drain ever plugs it will be more of a nuisance than a convenience. The removal of snow and ice in winter also must be considered.
>
> "In spite of all this I like the idea and am wondering if the areaway could be placed in the rear of the house and covered with a door, counter balanced perhaps, similar to the sloping door commonly used on outside basement entrances.
>
> "I like the bin with the sloping bottom and shovel boxes and prefer the 8'-0" x 8'-9" size over the 6'-0" x 8'-9" size, both for the convenience of the house holder and the fuel merchant. We have built a number of bins with plywood bottoms and find that an angle of 37°, as proposed, is satisfactory for coke. We have also found, however, that the bottom should be laid with moisture-proofed plywood since ordinary plywood peels due to moisture. This is important. Ordinary non-moisture-proofed plywood can be used for the side walls. We have used 1/2 inch or 5/8 inch plywood for the bottom but I have no data to show that 3/8 inch plywood is not strong enough.
>
> * * * * *
>
> "The distance from the shovel boxes to the fire door of the heater is not given on the drawings but it scales to about 6 1/2 feet. This appears to be an optimum distance for it does not cramp the shoveler and yet does not require more than one step in turning from the bin to discharge the shovel into the fire pot."

From Mr. E. R. Kaiser (Bituminous Coal Research, Inc.), letter dated May 17, 1947:

> "In attempting to modify the house design to permit the use of solid fuel, you have encountered all of the obstacles that normally confront architects and builders when they attempt to do the same thing. The changes that you have proposed seem to be satisfactory to me, and they indicate that the cost of the house for use with coal will be somewhat higher than for use with gas. I suppose this is to be expected, but many people interested in the use of coal have attempted to overlook these factors. I had the same experience in building a house in Columbus, Ohio, in 1940.

> ". . . . .the tonnage that can be stored in the bin with sloping bottom is small. It will be necessary for the householder to obtain coal again during the middle of the winter. However, if the bin is made larger, valuable space is taken up in the basement, which some householders may not want. The size of the bin could probably be made optional.
>
> "One thought that is quite definite in my mind is that you should obtain true and complete costs on all construction required for the coal-heated house that would be in excess of that required for the gas-heated house. The ash-set-out areaway called for additional construction which may cost a considerable fraction of the entire heating plant. Likewise, the bin will be an expense. You have an excellent opportunity in these two designs to determine how much more must be paid for the privilege of using coal."

## CHIMNEY DESIGN

On May 5, 1947, Mr. Lorimer, architect of the Industry Engineered House, wrote in part as follows:

> "One point which has bothered me recently in connection with the general application of these plans throughout the country, has been the need for two separate flues where warm air heating is used, as in such cases a separate hot water heater is required.
>
> "The FHA Minimum Property Requirements indicate that separate flues should be provided.* I have accordingly revised the basic plans to make it possible to use an 8" x 12" modular flue for the furnace and an 8" x 8" modular flue for the hot water heater. The problem would be somewhat simplified if 8" x 8" flues can be used in each case. I know that this is quite adequate for most oil fired and gas fired units, but I am not sure what is required for the solid fuel furnace for such a small house."

Mr. Lorimer's reference to "modular flues" is to a new group of flue linings which have been designed to coordinate with the 4-inch module recommended by the American Standards Association's project on modular coordination for building materials. These new flue linings are considerably smaller than the original flue linings of comparable nominal dimensions. A partial list of the new flue sizes is shown on the next page in the form of a table comparing them with older standards.

---

*This reference is probably to the statement "Separate flues are required for each appliance which depends upon sustained draft for proper operation." See Minimum Property Requirements for Properties of One or Two Living Units, (State of Indiana), published by the National Housing Agency, Federal Housing Administration, September, 1946; section 503-A. This requirement is not specified by the National Board of Fire Underwriters. Many existing homes have both a solid fuel heating unit and solid fuel water heater connected to the same breeching.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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[illegible]

RECTANGULAR CLAY TILE FLUE LININGS

| New Modular Units | | | | Old Standard Units | | |
|---|---|---|---|---|---|---|
| Nominal Dimensions (inches) | Outside Dimensions (inches) | Wall Thickness (inches) | Net Inside Area (sq.in.) | Outside Dimensions (inches) | Wall Thickness (inches) | Effective Area (sq.in.) |
| 8 x 8 | 7½ x 7½ | .625 | 35 | 8½ x 8½ | .625 | 41 |
| 8 x 12 | 7½ x 11½ | .750 | 57 | 8½ x 13 | .750 | 70 |
| 12 x 12 | 11½ x 11½ | .875 | 74 | 13 x 13 | .875 | 99 |

In view of the fact that the 8½" x 13" flue had been established in a more or less arbitrary manner as the minimum flue to be used for heating plants of residential structures, and that its use and specification was a matter of habit rather than of design, it seems safe to recommend that the new 8" x 12" flue be considered as adequate, in spite of the fact that this means a reduction in the effective area of from 70 sq.in. to 57 sq.in. Professor Provine, Head of the Department of Architecture, University of Illinois, indicated that the newest edition of the Building Code recommended by the National Board of Fire Underwriters would omit specifications for flue sizes, so the 8" x 12" flue would not be contrary to this code.

It does not seem safe to recommend the use of the 8" x 8" flue for a central heating plant, although actual investigation may indicate that such a flue is perfectly satisfactory. Certainly in small residences where the heat loss is on the order of 40,000 to 50,000 Btu., the 8" x 8" flue would seem to be comparable to a 6-inch smoke pipe which is often used for an ordinary stove.

In view of the above facts, a letter was written to Mr. Lorimer on May 12, 1947. The following quotations are taken from this letter:

> "I can give you very little good information on flue sizes. The accepted minimum flue size for residential heating plants is the old standard 8½" x 13" flue (effective area — 70 square inches). The 8½" x 8½" flue (effective area — 41 square inches) is acceptable for a water heater. The 8½" x 13" flue is the smallest flue shown in the table given by the Guide of The American Society of Heating and Ventilating Engineers.

"These recommendations follow closely the Building Code recommended by the National Board of Fire Underwriters, section 1101, paragraph 8 (a) which states:

> '8. Sizes of flues.
>
> (a). The cross sectional areas of smoke flues shall be designed and proportioned to meet the conditions of temperatures, within and without the flue, thickness of masonry, exposure, shape and material of flue and other influences; for solid or liquid fuels they shall be not less than seventy square inches for warm air, hot water and low pressure steam heating appliances; not less than forty square inches for ordinary stoves, ranges and room heaters; not less than twenty-eight square inches for small special stoves and heaters; not less than fifty square inches for fireplaces, but at least one-twelfth of the fireplace opening.'

"All of these recommendations are based on practice, and take into consideration cases where flues may be crooked, excessive soot in flues, etc. Theoretical calculations show much smaller flues are required.

"The new modular size flues are much smaller for approximately the same nominal dimensions. In answer to your question, the 8" x 8" flue would not be recommended for the heating plant. I would not use less than the 8" x 12" size. Even this size is smaller than required by the Board of Fire Underwriters.

"You can save some space by the elimination of the brick withe between the two flues. This is permitted by FHA Minimum Property Requirements, Article 406-L entitled 'Masonry Chimneys', paragraph 5b, which states: 'two flues may be grouped without withes provided joints of lining are staggered.' The Fire Underwriters code also allows this.

"Research on flue sizes and chimney draft is being conducted at Battelle Memorial Institute, Columbus, Ohio, as part of the program of Bituminous Coal Research, Inc. The Bureau of Standards has done some work along this line, but as yet nothing has been published. The new modular flues should be considered by these projects."

COMMENTS

Copies of the above letter were sent to representatives of the sponsors and the following comments were received:

From Mr. H. R. Grover (Anthracite Institute), letter dated May 28, 1947:

> "You mention two flues in the last paragraph on page 1 of your letter to Mr. Lorimer, whereas only one flue 8" x 12" is shown on the plans submitted to us.* When scaled to elevation view on the blueprint it is approximately 20 feet measured from the basement floor level to the top of the chimney. A single flue of these dimensions is ample for anthracite.
>
> "Our representatives made a heat loss calculation which indicates that the total hourly B.T.U. loss for a temperature differential of 0 to 70 degrees is about 51,000 B.T.U.'s, so that the maximum amount of coal which would have to be burned in any one hour to take care of maximum heat demand would be less than seven pounds.
>
> "Our representatives feel that the emphasis should be placed on tight construction in a chimney flue even to a greater extent than size.
>
> "In this particular house, if they were given a choice between an 8" x 12" chimney, built in the usual careless manner with very little, if any, cement between the liner joints, they would refuse to accept it and instead would specify an 8" x 8" flue lined chimney that must be smoke tested for leaks before acceptance."

From Mr. C. E. Shaffer (American Coke and Coal Chemicals Institute), letter dated May 23, 1947

> "Regarding flue sizes, we know that coke generally requires less draft than other solid fuels and therefore that we could probably get by with smaller flues. However, I believe that we should recommend a flue that will take care of all fuels under all conditions and that the code of the National Board of Fire Underwriters should be adhered to."

---

*The first plans of the house showed one flue; later plans showed two flues in one chimney.

Upon examination of the tentative Third Report, Dr. Harold J. Rose (Bituminous Coal Research, Inc.), made the following comments concerning chimneys in a letter dated April 7, 1948:

"Relative to the minimum size of chimney flues see U. S. Dept. Agric. Farmers Bull. 1889, 'Fireplaces and Chimneys'. This recommends for flat grate furnaces, burning soft coal, and having 1 sq. ft. grate area, a flue lining of 8-1/2 x 8-1/2 outside dimension, 22 ft. high at sea level, or 32 ft. high at 4000 ft. elevation. One sq. ft. grate would be a 14" circle. Assuming a fuel consumption of 7-1/2 lb. per hour this would give well over 50,000 Btu/hr total heat liberation in the premises.

"For larger grates up to 3 sq. ft. and 2,000 ft. elevation, a nominal 8-1/2 x 13" flue lining is recommended.

"Battelle has made numerous chimney tests for BCR. Their 2nd progress report, Fig. 14 shows that a masonry chimney with 6-3/4 x 6-3/4 inside dimension flue liner (45 sq. in.) and only 13 ft. high above the grates, gave the following measured draft, at 40 cu. ft./min. (180 lb/hr) gas flow. This is equivalent to burning 7-1/2 lb. coal per hour with 9% $CO_2$ or about 100% excess air.

| Inlet temp. | Measured draft. |
|---|---|
| 220°F | 0.030 in. $H_2O$ |
| 600 | .081 |
| 1016 | .105 |

"In general, small domestic appliances develop full rating at 0.06" draft (or less). Furthermore stack temperatures at full rating are apt to be well over 600°F. Therefore the small chimney should do an acceptable job provided that other conditions are not unfavorable such as adverse wind effects, crooked or partially blocked chimneys, etc."

[illegible]

[illegible]

[illegible]

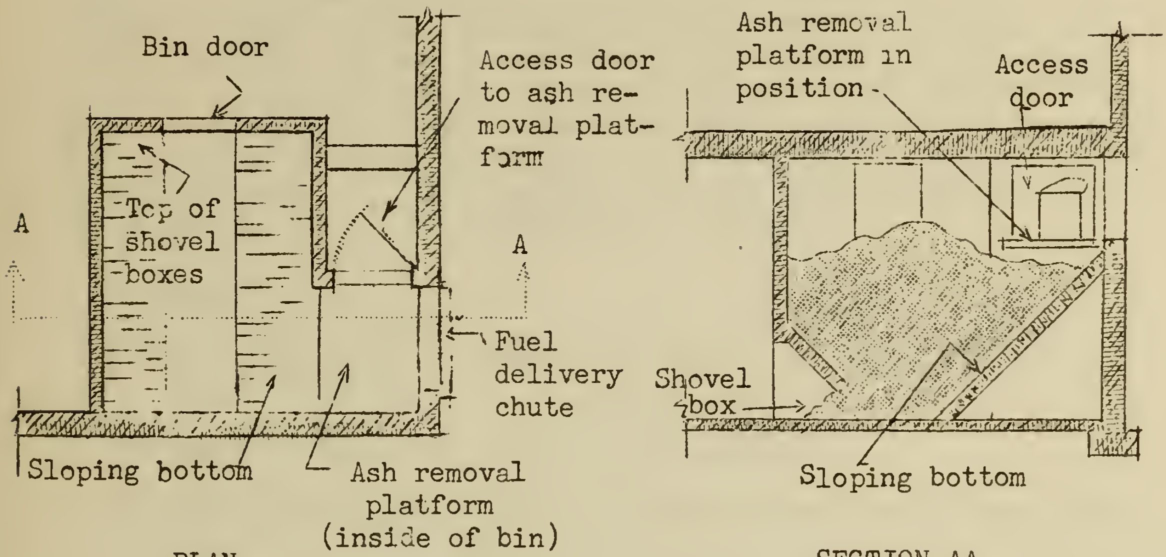
[illegible]

| [illegible] | [illegible] |
|---|---|
| [illegible] | [illegible] |
| [illegible] | [illegible] |

[illegible]

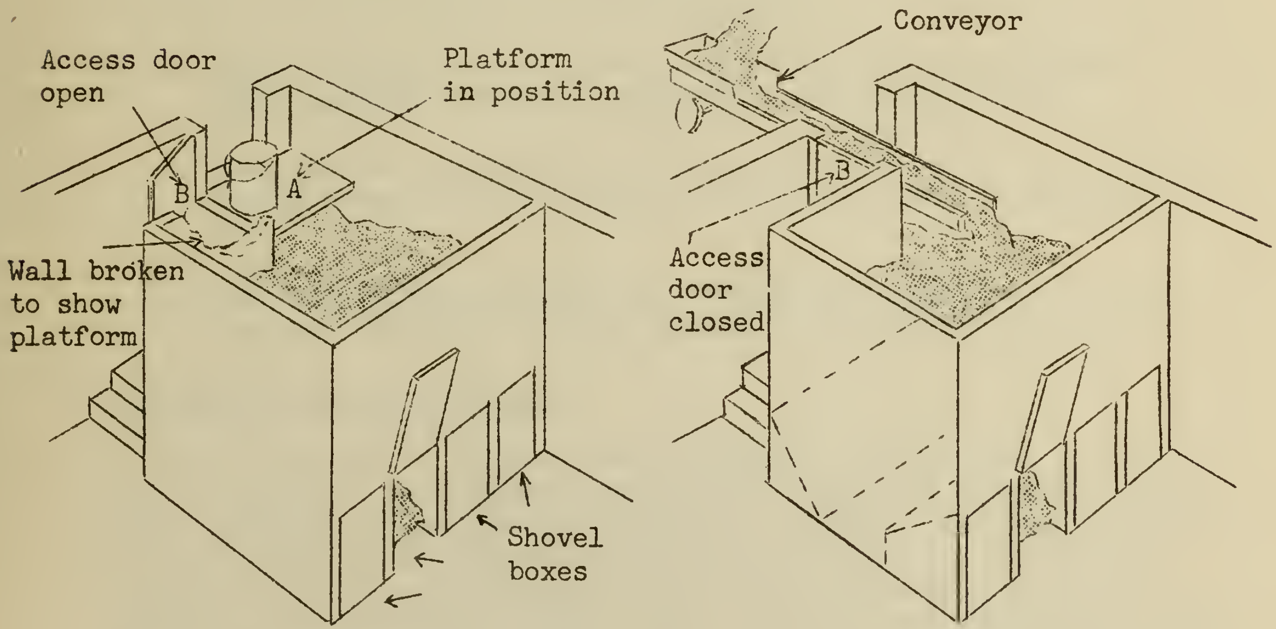
## THE DUAL PURPOSE FUEL BIN CHUTE

In his letter of May 5, 1947, Mr. Lorimer included a sketch showing a suggested means for utilizing one window for both fuel delivery and ash removal. This device is illustrated below.


Bin door
Top of shovel boxes
A
A
Access door to ash removal platform
Fuel delivery chute
Sloping bottom
Ash removal platform (inside of bin)
Ash removal platform in position
Access door
Shovel box
Sloping bottom

PLAN

SECTION AA



PERSPECTIVE

Interior view showing ash removal platform in use

PERSPECTIVE

Interior view showing arrangement for fuel delivery--platform removed, access door closed

figure 13

The dual purpose chute functions in this way: When the fuel is delivered, the platform (marked "A") and its supports are removed, the small door (marked "B") is closed, and the bin is filled. After the delivery, the small door is opened and the platform is replaced over the fuel in the bin.

During routine use of the bin, the platform remains in place. When ashes are to be removed, the small door is opened and the ash containers are raised up to and placed upon the platform. The containers may then be removed from the outside through the fuel-delivery chute door. Mr. Lorimer's original sketches showed a sliding window rather than the metal delivery chute door. The metal chute was substituted by this project, as it was believed that the window would not be satisfactory, due to the possibility of breakage.

Advantages

(1) Savings from $100 to $150 over any other scheme proposed for the house.

(2) Ashes are kept out of the cold and wet.

(3) There is no areaway to keep clear of snow, ice, leaves, etc.

(4) There is no detraction from the appearance of the house.

Disadvantages

(1) It is more difficult to fill the bin.

(2) Ashes must be lifted approximately 4'-0" to the platform. (The ash-setout areaway requires a lift of only 30".)

(3) Fuel must be leveled under the delivery window to accommodate the platform and its supports, which are actually inside the bin.

(4) The fuel-deliveryman must go through the house to get to the basement, unless he crawls through the delivery window.

## Conference with the Architect

On June 16, 1947, Mr. Lorimer was in Urbana. At that time the solid fuel problems of the Industry Engineered House were discussed. It was agreed that no completely satisfactory solution had been developed. The criticisms of the uncovered ash-setout areaway and the outside basement stair were reiterated--the problems of keeping both the areaway and stair free of leaves, snow, and ice; the appearance of the ash-setout areaway, especially in front of the house; and most important of all, the extra cost of construction involved in order to provide for solid fuel. Mr. Lorimer offered the suggestion that the Dual Purpose Fuel Bin Chute was the answer, as it was much less costly. Discussion of the advantages and disadvantages of this proposal developed as previously outlined.

## Dual Purpose Fuel Bin Chute Submitted to Sponsors

Drawings of the dual purpose fuel bin opening were prepared and sent to the sponsors of this project with the request for their comment. Subsequently, the drawings were discussed at the July 15 meeting of the Joint Technical Committee of the ABC Industries. Both the written and oral comments were much the same. There was considerable objection to the height to which the ashes would have to be raised in order to place them on the platform. It was suggested that such a lift would not be possible for an old man or for some young boys who often tend furnaces. Also it would not be a desirable provision in those houses where women were required to fire the furnace and remove the ashes. Another major objection was to the difficulty that the arrangement would probably cause in delivering fuel. As long as the ultimate object in designing a bin is to make it possible to fill the bin as completely as possible from the outside, the arrangement shown would probably be unsatisfactory. The general feeling toward this scheme was one of disapproval, in spite of the fact it was recognized that it would be much more economical than any other scheme.

## CONCLUSIONS

After working several months with this house, it was quite apparent that the plan of the house is an excellent example of what not to do when planning for solid fuel use. It is quite clear that the difficulties involved in using solid fuel in this house could easily have been overcome had more thought been given to the original plan. The experience with the Industry Engineered House is excellent proof of the need for careful consideration and planning when solid fuels are to be used for residential heating. The report on this house has been written in detail in order to explain properly the many details which must be considered in designing for solid fuel.

## III. RESEARCH RESIDENCE

During the month of June, 1947, the Small Homes Council of the University of Illinois decided to build a research residence on its Home Research Center site. It was decided to use the plans of the Industry Engineered House for this residence. It was proposed that this house might be used by any group desiring to try out new products, new materials, or new ideas. Since the Research Residence was to be built following the plans of the Industry Engineered House, the residence offered an opportunity for this project to build and test some of the "remedies" which had been proposed in order to make the house suitable for a solid fuel heating installation.

This project entered into an agreement with the Small Homes Council to build (1) an outside basement stairway, (2) an ash-setout areaway, and (3) a fuel bin. In return for furnishing these features, the project was given the right to use a portion of the basement for further experiments and demonstrations. It was also agreed that the occupants of the house would report upon the merits and demerits of the installations, and that the Small Homes Council would secure cost data on the construction of these features.

This project was also instrumental in contacting Professor Julian Fellows of the Mechanical Engineering Department in order to obtain for the house a production model of the new smokeless furnace which he designed. This furnace will be furnished by the Lennox Furnace Company of Marshalltown, Iowa.

## IV. EMPLOYEES

On May 31, 1947, Mr. Gerhard Rettberg, half-time draftsman of the Residential Planning Project, resigned to accept a full-time position with the Small Homes Council. On June 26, 1947, Mr. William Eng, graduate student of the Department of Architecture, was employed as a half-time draftsman.

## V. MEETINGS AND CONFERENCES

The writer has attended the following meetings and conferences in connection with the work of the Project:

Indianapolis Home Show, April 18-27, Indianapolis, Indiana. Visited Home Show Saturday and Sunday, April 19 and 20. Attended luncheon meeting of Indianapolis Construction League, April 19.

Annual Meeting of the American Coke and Coal Chemicals Institute, June 9-11, French Lick Springs Hotel, French Lick, Indiana. The subject of the general session held on June 10th was "Coke." The writer spoke before this meeting to explain the work of the Residential Planning Project.

Conference with Mr. A. Gordon Lorimer, Technical Advisor of the Producers' Council, June 16, 1947, at Urbana, Illinois.

Respectfully Submitted,

Rudard A. Jones

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